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EXECUTIVE SUMMARY

Title: Unguided Rocket Employment: Why We Must Update Marine Corps Rotary Wing Attack Training

Author: Major Richard D. Joyce, United States Marine Corps

Thesis: The AH-1W, due to the versatility of the aircraft and its crew, has played a pivotal role on every battlefield since its inception. Today's AH-1W pilots, remembering important lessons from the past, must fully develop the weapons employment skills necessary to remain effective, versatile, and therefore relevant in future conflicts.

Discussion: The success of the AH-1W helicopter rests primarily on its versatility and that of its pilots. The ability to adapt to enemy threats throughout the spectrum of conflict and provide MAGTF commanders with quick, responsive, and effective fire support has been the hallmark of the community for years. One aspect of versatility inherent with the AH-1W is its variety of weapons capabilities. Complimentary weapons, such as precision guided munitions (PGMs) and unguided ballistic munitions, allow pilots to adapt to an ever-changing environment. Versatility does not, however, rest solely with the weapons. Aircrews must remain proficient in effectively and accurately employing those weapons. That versatility, however, may be degrading. An analysis of the limited data available reveals a significant lack of proficiency in rocket delivery accuracy. Analyzing data from the last 15 Weapons and Tactics Instructor (WTI) Courses shows a student average miss distance in excess of 59 meters from the intended target. Unfortunately, no consistent performance standards exist in the current Training and Readiness Manual (T&R) by which to judge proficiency in this skill. Equally disconcerting are the observations by community subject matter experts that many pilots are content to rely solely on precision guided munitions for increased accuracy; this is a tenuous proposition considering technology can fail and external factors can affect PGM accuracy.

The current T&R Manual Program of Instruction, consisting of only eight training events dedicated to unguided weapons employment, does not provide enough focused training to effectively develop that skill set. Although other weapons employment training opportunities exist, the focus during those events does not center on developing the fundamentals of accurate weapons employment. Additionally, the T&R Manual lacks needed performance standards required to effectively assess and evaluate individual pilot skill proficiency and therefore ensure both a common base of training and depth of combat capability throughout the community.

Conclusion: AH-1W pilots must possess the needed skills to effectively employ all of their organic weapons systems. Failure to do so results in a lack of mission versatility and potentially, reduced relevance in future conflict.

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PREFACE

The purpose of the following study is to examine specific issues relating to performance standards for unguided weapons employment within the Marine Corps rotary wing attack aviation community. More specifically, this study will examine whether the training syllabus established in the current AH-1W Training and Readiness Manual provides an adequate amount of training at the right phase with respect to unguided weapons employment, and if so, by what measure are those skills evaluated in order to ensure minimum standards are achieved throughout the community. I have limited this study to the Marine Corps' only rotary wing community whose *primary* mission is providing fire support: the AH-1W Cobra. This study focuses on the standards established for unguided weapons employment and the program designed to train pilots to those standards. It is not designed to provide a detailed analysis of the many factors that may affect weapons accuracy, nor does it focus on issues relating to maintaining skill proficiency once designation as Attack Helicopter Commander is complete.

I have two main motivations for presenting the following analysis. First, as an attack pilot, no skill is more important than being able to place the right ordnance on the right target at the right time in order to support the Marine on the ground. I believe that since the end of the Cold War in the early 1990's, attack helicopter training has remained focused disproportionately on the anti-armor mission and the employment of precision guided munitions. The result of this has been a tendency to relegate unguided munitions employment to a secondary skill status and dismiss deteriorating pilot skills with the "it's only a suppressive weapon" argument.

My second motivation revolves around the military's propensity to look to technology for solutions. Current initiatives for weapons procurement involve a laser-guided rocket that should produce accuracy numbers comparable to precision guided munitions. The problem with this,

however, is that it takes the reactive nature of the rocket away, increases the minimum employment range to over 1,110 meters, complicates the profile and geometry required to engage a target, and ignores advances that can be made through individual training. Although we should continue to develop these technologies, we must not rely on technology as the sole solution.

The versatility of the attack helicopter mandates that we maintain the capability to conduct a wide variety of missions and profiles. As an attack community, weapons employment must be at the forefront of training. It does no good to execute the most detailed and complex mission if failure results because the required skills once in the objective area are not there.

ADDITIONAL CONSIDERATIONS

ASSUMPTIONS

- The AH-1W will remain an integral component within the Aviation Combat Element of the Marine Air Ground Task Force for the foreseeable future.
- The AH-1W will continue to be employed in operations that range the full spectrum of conflict.
- No significant changes to the AH-1W mission or Core METL will occur in the near future.
- No emerging weapons technologies negate the need to maintain the ability to employ unguided weapons in various threat and environmental conditions.

LIMITATIONS

- This paper does not include an in depth study of the effects of ballistics on unguided munitions.
- This paper is primarily limited to rocket employment due to a lack of research data available with respect to 20mm cannon employment.
- This paper does not address the potential impacts to resources or funding any recommendations may have. It focuses instead on determining if training deficiencies exist and if so, provides recommendations to address those deficiencies.

RECOMMENDED FURTHER STUDY

- The role of rotary wing attack helicopters in counterinsurgency operations. Specifically, what aspects of the COIN environment affect either the type of weapons employed or the employment profiles used by attack helicopters? Previous studies tend to be fixed-wing centric and focus on the need for precision munitions in order to minimize collateral damage, but ignore the idea that increased standoff ranges inherent in PGM employment may not be possible. I believe the COIN (or possibly future Distributed Operations) environment presents the possibility of small-sized ground units dispersed throughout the battlefield that may or may not have trained Joint Terminal Area Controllers attached to them. When and if fire support is needed, the situation has a potential to be chaotic, requiring attack helicopters to get in close overhead, quickly gain situational awareness, determine friendly and enemy locations, and provide the fire support required in an expeditious manner with minimal fires "geometry" set up. These situations may preclude the pilots' ability to accept the increased time and standoff associated with PGM employment.
- The role of simulators in unguided weapons employment training. Simulators are extremely valuable in teaching checklist procedures, proper armament system switchology, and precision guided weapons training, but have limitations when teaching unguided weapons employment. Limitations in visual acuity, field of view, and aircraft "feel" all have negative impacts on the overall training. The recommended study should seek to determine the appropriate balance of aircraft versus simulator training.

UNGUIDED WEAPONS EMPLOYMENT

The fact remains that rockets are necessary in all attack helicopter operations, but they are a crucial combat multiplier in LIC because of the nature of the combat and the environment in which it normally occurs.[1]

Lt. Col. Lawrence E. Casper, USA
February 1992

UNGUIDED WEAPONS EMPLOYMENT OVERVIEW

What is *unguided weapons employment* and why should the Marine Corps consider it an important skill for AH-1W Cobra pilots? Unguided weapons employment is simply the "timely and accurate delivery of rockets and 20mm cannon fire."[2] Unlike precision guided munitions (PGMs) such as the Tube-Launched Optically-Tracked Wire-Guided (TOW) or Hellfire missiles that are "steered" to the target by wire guidance, laser mark, or radio frequency guidance, unguided weapons are ballistic munitions. Once the pilot places the aircraft into the attack profile and pulls the trigger, he or she no longer has the ability to influence where that fired rocket or round will go.

Several factors affect the accuracy of ballistic munitions. Amongst these are rocket characteristics, 20mm ammunition characteristics, AH-1W rocket delivery system limitations, weapons boresight errors, atmospheric conditions, interior ballistics, exterior ballistics, range to target, and aircrew skill. The aircrew's ability to affect the majority of these factors is beyond their control. Hence, pilots must therefore train to overcome these inherent effects. They must develop individual and repeatable techniques to deliver unguided weapons accurately.

WHY UNGUIDED WEAPONS EMPLOYMENT SKILLS ARE IMPORTANT

Perhaps the single greatest attribute of the modern attack helicopter is versatility. The opening remarks of the AH-1W Combat Aircraft Fundamentals publication states, "AH-1Ws support air, ground, and surface units by providing responsive fire support when and where it is required."[3] At first glance, this statement does not appear to hold much significance. Consider,

however, the challenges and scope of capabilities required to fulfill its idea. AH-1W aircrews must maintain the capabilities to support operations ranging from low-intensity humanitarian aid missions in remote undeveloped countries of the Pacific, high-intensity conventional warfare on the plains of Europe, mid-intensity irregular warfare in the deserts of the Middle East, and everything and everywhere in between. Meeting those challenges and developing those capabilities and skill sets is no simple task.

Versatility is not only the AH-1W's greatest attribute, but also the very characteristic that preserves its relevancy in future conflicts. Its multi-mission capability and the ability to reconfigure weapons systems in order to adapt to any threat environment across the spectrum of conflict significantly increases a MAGTF commander's flexibility. The AH-1W has played a pivotal role in every conflict since its inception during Vietnam and continuing through Operation Iraqi Freedom. Versatility is not, however, simply the ability to reconfigure weapons systems and move to a new area of the battlespace. The aircrews executing the missions must attain and maintain the requisite skills necessary to perform its multi-mission role.

Although precision guided munitions have moved to the forefront of research and development throughout the past three and a half decades, ballistic munitions remain viable weapons that have no substitute on the battlefield. Ballistic munitions allow aircrews to provide very responsive and quick reaction fire support when needed. The 2.75" rocket, for example, is an extremely simple, reliable, relatively inexpensive, and lethal weapon that affords attack pilots the ability to quickly respond to enemy threats (point and shoot).[4] Additionally, unlike many precision guided munitions, the enemy has no countermeasure capability against ballistic munitions.

By contrast, the accuracy and standoff capability of precision guided munitions remains unquestionable, but they do have significant limitations and are not applicable in all situations.

Precision guided munitions require aircrews to place the helicopter within specific release parameters to ensure the missile meets pre-launch constraints and captures its guidance mechanism (wire guidance or laser). This requirement translates into increased time between target identification and weapon impact, restrictions to the pre-launch helicopter flight profile, restrictions to the post-launch helicopter flight profile, and, ultimately, a reduced reaction time. Additionally, the TOW and Hellfire precision guided missiles remain adversely affected by atmospheric conditions, battlefield obscurations, and enemy countermeasures.

This research does not portray to identify specific capabilities and limitations of ballistic and precision guided munitions and then compare which is most suited for various threat environments. Indeed, it is the researcher's judgment that ballistic and precision guided munitions are complimentary weapons systems, each suited to fulfill specific requirements on today's battlefield. Because they are complimentary weapons systems, however, it is critical that AH-1W pilots maintain a high level of proficiency in delivering both weapons types. If the AH-1W community overlooks the importance of either system, it loses versatility and thus its relevance in future conflict.

ACCURACY SOLUTIONS: TECHNOLOGY OR TRAINING

The U.S. military remains on the leading edge of research and development, leveraging advances in technology to solve many of the issues it faces. Increasing the accuracy of various weapons systems within its arsenal rightfully comprises a sizeable portion of that research and development. It remains critically important that the military continue to increase its capabilities vis-a-vis potential adversaries in order to maintain its position as the world's most dominant force. The challenge lies in maintaining a balance between existing and potential capability so that technology does not become the perceived sole answer to all military needs.

Relevant to the research presented here, the Marine Corps is currently working to add the Advanced Precision Kill Weapon System (APKWS) as a program of record. The APKWS program centers on adding a laser-guided seeker to existing 2.75" rocket motors and warheads in order to increase their accuracy and minimize potential collateral damage. According to the 2007 Marine Aviation Plan, APKWS "will provide an R/W economic solution to fill the gap between costly anti-armor precision-guided munitions and the less costly unguided general-purpose rockets."[5] If successfully fielded, APKWS will provide essentially a precision-guided 2.75" rocket. Although accuracy is greatly improved, the same limitations inherent in precision guided munitions will also apply. Two questions thus arise: Is technology the only answer to increased weapons accuracy and should the AH-1W community view technology with some caution?

TECHNOLOGY: A HISTORICAL LESSON

One can hardly help thinking back to the overreliance on technology and the single mission focus that affected the United States Air Force (USAF) during the early stages of the Vietnam conflict, resulting in aircrews with an unbalanced mix of skills.[6] In addition to the single mission focus, the Air Force also misread the capabilities required of its fighter community to remain relevant in the conflicts of the time. "The nuclear emphasis of U.S. defense strategy throughout the 1950s and an associated conviction among many that the days of aerial dogfighting were over, neither the Air Force's nor the Navy's fighters developed during that period were designed to prevail in the close-in air combat arena that predominated over North Vietnam."[7] Most notable of these fighters was the F-4 Phantom. Designed as a long-range interceptor to counter a predominantly Cold War threat, F-4 weapons capabilities centered on long, medium, and short-range air-to-air missiles while ignoring the need for a close-in gun capability.[8] By focusing on

missile technology only and adapting pilot training to it, the F-4 lost versatility in confronting the threat presented in the skies over Vietnam.

Today, the AH-1W community stands at a similar crossroad. It will either take the path to overreliance on complex precision guided missile systems, or take a route that requires the community to strike a balance between adapting precision guided technologies to ballistic munitions and simply accepting the positive attributes of ballistic munitions (simple, reliable, versatile, and lethal) and focusing on training aircrews to employ them more accurately. Advances in technology must continue to remain dominant, but must not become the sole solution to every problem.

AH-1W TRAINING AND READINESS (T&R) MANUAL

> *Training events are based on specific requirements and performance standards to ensure aircrew maintain a common base of training and depth of combat capabilities.*[9]
>
> *MCO 3500.48A Aviation Training and Readiness (T&R) Manual, AH-1*

BASIC T&R CONCEPTS

The first step in examining the adequacy of the AH-1W Training and Readiness (T&R) Manual and associated Program of Instruction (POI) is to establish the link between missions assigned to a unit, the skill sets required in order to accomplish them, and the syllabus developed to train those skill sets. The mission of a Marine Light-Utility Attack Squadron (HMLA) is to "support the MAGTF Commander by providing offensive air support, utility support, armed escort and airborne supporting arms coordination, day or night under all weather conditions during expeditionary, joint, or combined operations."[10] The critical tasks necessary to carry out this mission are contained in the Core Mission Essential Task List (METL). Each aviation community

establishes a Core METL that provides a "standardized list of tasks a tactical unit / operational support unit must be able to accomplish during combat or contingency operations."[11] Appendix B depicts the Core METL for the AH-1W community. The Core METL originates from Marine Corps Tactical Tasks (MCTs) outlined in MCO 3500.26 and forms the basis for the unit-training program.

The Core METL relates to individual pilot skills through designated Core Skills. "Core skills are specific mission-related task areas that support a community's METL and consist of like T&R events (200-300 level)."[12] Appendix C shows the relationship between Core METL and Core Skills. In basic terms, these are the critical individual pilot skills necessary to develop in order to ensure the squadron's ability to conduct its assigned mission. A building block approach to training frames the overall concept of the T&R program. By mastering the required Core Skills, individual pilots increase the squadron's overall combat readiness. An individual pilot's training is "based upon a logical progression of increasingly challenging events, with the requirement for periodic revalidation of individual skill proficiency."[13]

CORE SKILLS

The AH-1W T&R contains eight Core Skills: Terrain Flight (TERF), Reconnaissance (REC), Specific Weapons Delivery (SWD), Escort (ESC), Offensive Air Support (OAS), Advanced Night Systems Qualification (ANSQ), Forward Air Controller (FAC), and Electronic Warfare (EW). Appendix D contains detailed definitions of the eight Core Skills and describes the training goals for each phase. This study examines issues surrounding unguided weapons employment up to a pilot's designation as an Attack Helicopter Commander (AHC). The AHC designation is critical because that is the point where the squadron commander designates the pilot as being capable of delivering aviation fires in support of ground forces in combat. As such, this report examines only

the detailed Core Skills of SWD (Specific Weapons Delivery), OAS (Offensive Air Support), and ANSQ (Advanced Night Systems Qualification). Appendices E, F, and G contain detailed excerpts from MCO 3500.48A relevant to the SWD, OAS, and ANSQ core skills.

T&R SYLLABUS STRUCTURE: EVENTS, STAGES, AND PHASES

The T&R syllabus is designed so that as an individual pilot continues to progress, he or she faces more demanding challenges in ensuing events. The lessons learned during the conduct of an initial training event form the foundation for follow on events, hence the building block approach. In order to map out this progression, the T&R is broken down into events, stages, and phases.

An *event* is simply a single training evolution within a given syllabus. The T&R describes the necessary details to conduct each required event: goal, requirement, performance standards, prerequisites, ordnance, external support, etc. These details provide the Pilot Under Instruction (PUI) everything he or she needs to adequately prepare to execute the event and defines what is expected of them by way of performance standards.

A *stage* is comprised of similar events within a given phase. A stage centers on a single Core Skill. For example, SOAS-260, OAS-261, and OAS-262 are all part of the 200-level "OAS" stage. Each Core Skill has an associated stage within one or more phases.

Finally, a *phase* contains a group of stages that comprise a syllabus level (i.e. 100, 200, 300, 400, etc.). A PUI progresses through three distinct phases en route to designation as an AHC. The first is the Core Introduction Phase (100 level) and is conducted by the Fleet Replacement Squadron (FRS). This phase centers on initial aircraft familiarization, crew procedures, and an initial exposure to Core Skills. The Core Basic Phase (200 level) focuses on five Core Skills: TERF, REC, SWD, ESC, and OAS. The training goal for the Core Basic Phase is front seat combat proficiency. Core Advanced Phase is the final one and focuses on four Core Skills: EW, OAS,

ANSQ, and FAC. "Upon completion of the Core Skill Advanced Phase, pilots shall be proficient in all core skills."[14] Appendix H depicts the established T&R Core Skill Progression Model.

UNGUIDED WEAPONS EMPLOYMENT AND THE T&R

Does the current T&R provide an adequate amount of unguided weapons employment training during each designated phase? The answer requires an analysis of the Specific Weapons Delivery (SWD) core skill. The purpose of SWD training differs depending on the phase of training the pilot is conducting. The training focuses solely on developing proficiency in weapons employment. SWD training events do not contain complex tactical scenarios that draw attention away developing proficiency in weapons employment.

During the Core Introduction Phase, FRS instructors introduce the basics principles of weapons delivery to the Pilot Under Instruction (PUI). The purpose of SWD during this phase is "to develop the ability to deliver air-to-ground weapons employing all available sensors and weapons systems."[15] The training emphasizes ordnance delivery techniques (flight profiles such as running, hover, and diving fire) and error analysis (identifying the potential reasons a rocket misses the target and making the needed corrections). Associated performance standards do not address accuracy, i.e. how close to the intended target the weapon impacts and what that distance is in order to successfully complete the training event (see Appendix I, Table 1).

The purpose of SWD training shifts during the Core Basic Phase to developing proficiency in weapons employment. "At the completion of this stage, the PUI will have displayed proficiency at delivering ordnance."[16] The T&R defines proficiency as "a measure of achievement of a specific skill."[17] What is that *measure of achievement?* SWD performance standards during this phase focus on four things: successful employment of 20mm or 2.75" rockets (i.e. getting the weapon off the aircraft), error analysis, working towards effect on target (an undefined phrase in the T&R), and

adhering to range regulations. Performance standards do not address specific weapons accuracy (see Appendix I, Table 2).

SWD training does not continue into the Core Advanced Phase. The T&R requires only 12 SWD training events through designation as an AHC, comprising 16% of total training hours (see Appendix I, Chart 1; SWD PGM plus SWD Rocket / Gun). Of those 12 training events, eight focus on unguided weapons employment (11%; derived from appendices E, F, and G). Of those eight training events, only five (six including ANSQ-314) require execution in the aircraft. That translates to 7% (derived from appendices E, F, and G) of total training hours prior to designation as an AHC spent focusing on unguided weapons employment and executed in the aircraft.

Additional weapons employment training opportunities occur during Offensive Air Support (OAS) core skill events. The purpose of the OAS stage during the Core Basic Phase is to "develop proficiency in OAS under varying threat conditions."[18] The emphasis, however, shifts to providing rotary wing Close Air Support (CAS) to ground forces. By the Core Advanced Phase, the purpose becomes "to develop the procedures and skill to tactically employ the aircraft during CAS and AI missions."[19] The T&R further states: "Upon completion of this stage, the pilot will be proficient in the planning, briefing, and execution of CAS and AI missions. In addition, the pilot will be proficient in the operation and employment of all organic weapons systems."[20] Although weapons employment training is inherent in all OAS events, the focus is not on accuracy, but on synchronizing engagements with ground forces or additional CAS assets. Most events during this stage involve complex tactical scenarios that require the PUI to exercise flight leadership and judgment beyond that required by an AHC. Instructors expect, i.e. assume, the PUI to be proficient in weapons employment.

When asked whether the current T&R provides an adequate amount of unguided weapons employment training sorties in order to develop the necessary individual pilot skills, the current Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) AH-1W Cobra Division Head responded:

> No. Not nearly enough ordnance delivery opportunities. Any sortie that launches without ordnance is part-task training at best. I believe that an ideal syllabus would include roughly 25% non-tactical rocket and gun employment at a scored range. We need to start treating our aircraft as if it were our T/O weapon. I recognize no strengths in the current syllabus, since there exists no valid standard to enforce.[21]

Another MAWTS-1 AH-1W instructor stated:

> We don't spend enough time simply developing the skill, teaching him to shoot rockets from high altitude, medium altitude, low altitude, in a hover, running, fast, slow, low angle, high angle, day, HLL, LLL, etc. . . . . Teach a guy to fly the aircraft and don't let him think about anything else until he can do that, then teach him to shoot it and don't let him think about "tactics" more than nose on target stuff until he can do that to a certain standard, then teach him about the finer points of OAS, assault support, etc.[22]

An analysis of the T&R and instructor interviews leads one to believe the current syllabus may lack the required training and be deficient in developing the necessary skills with respect to unguided weapons employment.

PERFORMANCE STANDARDS

The T&R Manual clearly states, "Training events are based on specific requirements and performance standards to ensure aircrew maintain a common base of training and depth of combat capabilities."[23] Although not said overtly, the implication of the above statement is that instructors utilize defined performance standards to evaluate whether the PUI has successfully met the requirements designated for each T&R event. By evaluating each PUI by defined performance standards, instructors can ensure pilots attain and maintain proficiency at core skills. Unfortunately, the T&R Manual does not define performance standards relating to weapons employment with

detail or consistency. Common phrases contained in performance standards for weapons employment in MCO 3500.48A (Appendices E, F, G, and I contain full descriptions) include: work towards effect on target, ordnance impacts within 30 seconds of TOT, achieve suppressive effects, delivery of 2.75 inch rockets or 20mm within 100 meters of target area, achieve the desired effects within 15 seconds of TOT, or per AH-1W TACMAN (no engagement standards exist in TACMAN). An analysis of current performance standards reveals that they are vague or undefined, based on timing and not accuracy, or inadequately address accuracy.

If the purpose of performance standards is to assist in maintaining "a common base of training and depth of combat capabilities,"[24] how are instructors to evaluate individual weapons employment skill against a standard of "to work towards effect on target?"[25] Today, current weapons employment performance standards are inadequate in clearly defining accuracy requirements. Weapons employment performance standards must be clearly stated and consistent throughout each phase of training.

CURRENT TRENDS

> *A rocket that misses the target by even 50 meters will have little to no effect on the target.*[26]
>
> *Air NTTP 3-22.3-AH-1W*

UNGUIDED WEAPONS EMPLOYMENT TRENDS

What are the current trends with respect to unguided weapons employment in the AH-1W community, and do these indicate a skill deficiency? Available data to answer these two questions is extremely limited. The following analysis focuses primarily on scored aerial gunnery range results complied by MAWTS-1 during its Weapons and Tactics Instructor (WTI) Courses.

Twice a year, Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) conducts the Weapons and Tactics Instructor (WTI) Course in Yuma, Arizona. AH-1W students (PWTI) attending the course conduct a "rocket derby" during the initial stages of the flight phase. The purpose is to determine PWTI proficiency in rocket employment. Students, crewed with MAWTS-1 Instructor Pilots, conduct the event during daylight conditions in the R-2301W Cactus West Range Complex (see Appendix J). The Cactus West range complex is a 3,000-foot wide target that consists of a 50-foot "bull's eye" with concentric rings at 75 feet, 150 feet, and 300 feet. Specific weapons impact points are scored via an AN/FXQ-8A(V) Weapons Impact Scoring Set (WISS). The WISS is an electro-optical system designed to measure the impact location of air delivered ordnance with respect to the target center.[27]

Appendix K depicts the results from this "rocket derby" over an eight-year period beginning with WTI Class 2-00 through WTI Class 1-08.[28] MAWTS-1 conducts the rocket derby as single flights of individual aircraft with no associated tactical or complex training scenario.[29] The event focuses solely on assessing the PWTI's rocket employment accuracy, thus a trend could be revealed.

DATA ANALYSIS

During the period covered by the data, no significant T&R changes occurred that altered the number of training events requiring ordnance delivery, the standard ordnance load per training event, or the performance standards associated with the training events. Appendix K, Table 1 depicts class average and individual student average miss distance calculated in both feet and meters. Note, blank cells indicate that individual student data is unavailable. Appendix K, Chart 1 depicts the class average miss distance as well as the class range (high and low student average). The conclusions from Table 1 and Chart 1 are as follows:

1. The average miss distance through 15 classes = 59.9 meters
2. There exists a large range of individual skill level (proficiency) with respect to rocket employment. The average miss distance range (difference between the high student average and low student average) for the nine classes containing individual student data = 72.9 meters
3. If one disregards the class with the highest average miss distance and the class with the lowest average miss distance, the remaining 13-class average = 59.8 meters
4. A comparison of classes from pre-OIF, WTI Classes 2-00 to 1-03, reveals a class average miss distance of 68.1 meters
5. A comparison of classes post-OIF, WTI Classes 1-04 to 1-08, reveals a class average miss distance of 54.4 meters (greater accuracy as a class)

Does the available data lead to the identification of any trends? Appendix K, Chart 2 identifies trends with respect to the high, low, and average miss distances.[30] Key conclusions from Chart 2:

1. The long-term trend for class average miss distance remains relatively constant; from a high of approximately 70 meters to a low of approximately 56 meters
2. The long-term trend reveals a gradual improvement in skill level (proficiency) over the previous 15 classes
3. The high student average miss distance (least accurate student) decreases dramatically from class 1-03 to 1-08 (a change of approximately 60 meters), thus indicating an increase in accuracy
4. The low student average miss distance (most accurate student) continues to gradually decrease, indicating a slight increase in accuracy

Appendix K, Charts 3-5 break the data down even further to explore what minor trends appear within the given data. This was further subdivided equally into three separate groups. The first group includes classes 2-00 through 2-02; the second, classes 1-03 through 2-05; and the third, classes 1-06 through 1-08. Conclusions drawn from Charts 3-5:

1. Trend analysis from classes 2-00 through 2-02 reveals an increasing class average miss distance; equating to a decrease in accuracy
2. Trend analysis from classes 1-03 through 2-05 reveals a decreasing class average miss distance (improved accuracy) and an average class range of 85.5 meters
3. Trend analysis from classes 1-06 through 1-08 reveals a gradual increase in class average miss distance (decreased accuracy), but an average class range down to 62.8 meters (indicating increased accuracy as a whole)
4. Instructors imposed additional restrictions on class 1-08 (PWTIs had to comply with newly established Weapons Release Envelope; see Appendix L); analysis

reveals that as a class, 1-08 had the second lowest class average miss distance (39.0 meters) and the lowest class range (38.1 meters)

Appendix K, Chart 6 depicts the final aspect of this data analysis and attempts to predict key trends that the AH-1W community must address. The purpose of Chart 6 is to establish a long-term trend based on the limited data available. Chart 6 extends the class average miss distance trend line, established over the previous 15 classes, out to a projected 10 additional classes (roughly a five year period). Long-term conclusions:

1. If no changes are made to the T&R, class average miss distance will continue to gradually decrease
2. If no changes are made to the T&R, the rate of decrease (indicating an improved skill level or proficiency) will continue to slow
3. If no changes are made to the T&R, trend analysis reveals that the class average miss distance will remain greater than 50 meters

If one accepts the research, thought, experience, and lessons learned that produced the community's tactical manuals and weaponeering guides, this long-term trend is unacceptable. "A rocket that misses the target by even 50 meters will have little to no effect on the target."[31] The T&R must contain a training syllabus designed to produce the skill level and proficiency required to be effective in combat.

RECOMMENDATIONS

HE rockets and 20mm are relatively low-yield weapons that allow close air support (CAS) to be employed at ranges much closer to friendly lines than other munitions permit. In order for this to be possible, supported elements must have a high degree of trust in rotary-wing close air support (RWCAS) aircrews that the ordnance will impact within a reasonable distance from the intended target.[32]

Air NTTP 3-22.3-AH-1W

PERFORMANCE STANDARDS

The AH-1W community must establish weapons employment performance standards in order to effectively train its pilots, ensure a common capability provided to the MAGTF

commander, and maintain the versatility of the attack helicopter. The T&R Manual must fully support established performance standards and provide adequate training opportunities to develop the required weapons employment skills. The established standards must be *effective, reasonable, adhered to, and nested in assigned Core METL and MCTs.*

Establishing *effective* performance standards requires a blend of science, experience, and common sense. For example, establishing rocket engagement standards based on the criteria of neutralization and then setting the performance standard at 50 meters is not effective. A pilot simply cannot neutralize a target with rockets if he or she cannot deliver rockets within a distance that physically affects the target. In a similar context, how effective are performance standards based on a criteria of suppression? MCRP 5-12A defines suppressive fire as "Fires on or about a weapons system to degrade its performance below the level needed to fulfill its mission objectives, during the conduct of the fire mission. . . Firing in the general direction of a known or suspected enemy location."[33] Can one translate these definitions into specific engagement criteria? What defines its specific effects? Is there training value gained by "firing in the general direction of a known or suspected enemy location?"[34]

In order for performance standards to be effective, the weapon must always be considered. A 2.75" high explosive (HE) rocket generally uses a M151 (HE-FRAG) warhead. This warhead contains 2.3 pounds of Composition B-4 explosive, weighs approximately 9.4 pounds, and has a bursting radius of 10 meters.[35] Based on those facts, is it effective to establish an engagement standard for 2.75" HE rockets at 50 meters? Establishing a 2.75" HE rocket performance standard at 10 meters is certainly effective based on the bursting radius of the rocket warhead. The question becomes whether that standard is achievable or not.

For performance standards to be *reasonable*, they must be achievable by the community at the Attack Helicopter Commander skill level (AHC designation authorizes the pilot to perform as a pilot in command of an aircraft and deliver aviation fires in support of ground forces in combat) and supported by the T&R weapons delivery syllabus. The data presented in this research demonstrates that the current T&R produces individual pilots whose skill level, on average, enables them to place a rocket approximately 59.9 meters away from their intended target. Notably, the pilot base for this data represents PWTIs, pilots whose skill level and proficiency exceeds that of an Attack Helicopter Commander. Would it be reasonable to establish a performance standard at 10 meters, for example, knowing that senior instructors currently cannot achieve that standard?

Once performance standards are established, the community must then *adhere* to them in order to improve individual pilot performance and ensure that ground forces have a reasonable expectation of the capability brought by the AH-1W in a combat situation. If a pilot fails to meet established standards, it is the squadron's responsibility to identify the problem areas, provide additional training opportunities to improve deficiencies, and uphold the standard. The AH-1W's primary role on the battlefield is providing Close Air Support (CAS) to ground forces. Those ground forces must have the trust and confidence that AH-1W crews will deliver their ordnance within a reasonable distance from the identified target.[36]

Finally, performance standards must nest within assigned Core METLS and MCTs. MCT 3.2.3.1 Offensive Air Support (OAS) states, "The principle effects created by OAS are neutralization and destruction."[37] It appears implicit in that statement that MCTs define the performance standard for all attack platforms that conduct Offensive Air Support (OAS). In order to ensure Core Skills and Core METLS adhere to MCTs, these criteria must provide the basis for performance standards with respect to weapons employment.

By establishing *neutralization* as the criteria for performance standards, the community accomplishes two goals. First, it synchronizes pilot core skills with standards established in MCTs. Secondly, it fosters a "target-based mentality with regard to mission accomplishment."[38] Joint Publication 1-02 defines neutralization fire as "Fire which is delivered to render the target ineffective or unusable."[39] The key aspect of neutralization is that one must affect the specific target. By focusing on a specific target, pilots must train to not only successfully release ordnance from the aircraft, but also conduct error analysis based on initial weapons impact, make appropriate adjustments, and re-engage in order to affect the target.

RECOMMENDED PERFORMANCE STANDARDS

Although skill levels will increase as individual pilots progress through the Core Basic and Core Advanced Phases, the T&R should establish one set of performance standards. Individual pilots must meet these standards prior to designation as an Attack Helicopter Commander. Again, pilots develop proficiency at core skills through a building block approach. There is no requirement for pilots training in the Core Basic Phase to meet established performance standards. The requirement is for pilots to demonstrate progress and increase proficiency in that core skill so they consistently meet the standard prior to completion of the Core Advanced Phase. It is the responsibility of the commander, instructors, and Standardization Board members to ensure individual pilots are progressing toward meeting established performance standards prior to that point.

How does the AH-1W community establish effective performance standards? As stated previously, the answer requires a blend of science, experience, and common sense. The Air NTTP 3-22.3 states that rocket impacts 50 meters from the intended target have little to no effect on the target (a view supported by experience in combat). The AH-1W NATIP clearly states that the

bursting radius of the 2.75" high explosive rocket carrying a M151 warhead is 10 meters. What is often overlooked are the additional effects such as heat flux, flash blindness, eardrum rupture, concussion, and limited fragmentation that can occur out to a distance of 30 meters. Establishing a 25-meter standard based on neutralization as the damage criteria forces pilots to attain a proficiency level commensurate with Marine Corps Tactical Tasks (3.2.3.1) and the characteristics of the weapon utilized. The following recommended performance standards should be included in the T&R:

> All ordnance shall be delivered within appropriate release parameters, to impact in accordance with the following performance standards:
>
> | Weapons System | Performance Standard | Desired Effect |
> |---|---|---|
> | 1. 2.75" Rockets | 25 meters | Neutralization |
> | 2. 5.00" Rockets | 35 meters | Neutralization |
> | 3. 20mm[40] | Rounds on target within 5 seconds | Neut / Dest |
> | 4. PGMs | Target Impact | Neut / Dest |
> | 5. Illumination | Judged by effectiveness | |
>
> Failure to achieve performance standards shall be considered mission failure.

Are the recommended performance standards for rocket employment reasonable? Again, neutralization requires that the pilot, through the employment of his or her weapons system, affect the target. As a performance standard, it is simply not good enough to "fire in the general direction of a known or suspected enemy location."[41] The unguided weapons employment trend analysis discussed earlier demonstrates that the AH-1W community faces a significant challenge to meet this standard. The rocket data collected during WTI Class 1-08 provides a glimpse of the possibilities for increasing accuracy through proper instruction; adherence to established tactics, techniques, and procedures; and scrutiny of pilot performance. When asked whether he had observed any general trends with respect to unguided weapons employment skill levels in the AH-1W community, the MAWTS-1 AH-1W Cobra Division Head replied:

> Increasing skill within those units that have begun to enforce the ANTTP Weapons Release Envelope. The exhausting condition is when pilots require "convincing" that they should really try to hit the target, as if it's up for debate. We definitely have a cultural problem in that area. Hopefully the latest generation of WTIs can fix this trend. . . Here at MAWTS-1 we evaluate every single Weapons Release Event during WTI, Desert Talon, and on fleet support. Ineffective Weapons Release Envelopes are analyzed and debriefed candidly. Negligent release events (blatantly outside of envelope) are at times grounds for an unsatisfactory evaluation.[42]

Additional challenges to achieving this performance standard stem from aircraft limitations and ballistic factors beyond the pilot's control. Recent adjustments to some maintenance procedures help reduce a few of these effects: "The pods are hung on the aircraft, boresighted, and stay on . . . since we implemented boresighted pods on aircraft 24/7, we've seen a marked improvement in training value per rocket as there are literally no excuses to miss other than poor technique."[43] Although pilots can never eliminate all of the variables associated with unguided weapons employment, the key is to eliminate as many as possible. Despite the challenges, through proper instruction, maintenance procedures, and adequate training, future Attack Helicopter Commanders can achieve the recommended performance standards.

RECOMMENDED T&R REVISIONS

The focus of weapons employment training within the Core Basic and Core Advanced Phases weighs disproportionately on skills required of advanced designations such as section leaders, division leaders, and instructors. There are simply not enough training opportunities focused solely on weapons employment. A young AH-1W pilot following the requirements of the T&R could progress all the way to his or her AHC checkride while conducting only six Specific Weapons Delivery (rocket and gun) events in the aircraft with live ordnance. That is simply unacceptable. Accurate weapons delivery, in particular unguided weapons employment, requires pilots to develop a repeatable and habitual process. That can only occur if supported by the T&R Manual.

The AH-1W community must determine what skills are absolutely critical for an AHC to posses as a wingman in combat. Does he have to be able to decipher every nuance of the Marine Air Command and Control System (MACCS)? Does he have to be the most detailed planner in the squadron? These questions, and similar ones, point out very important skill sets that instructors must introduce and begin to develop early in a pilot's progression. They are not, however, absolutely critical to fulfilling the role as an AHC. Brilliant plans and flawless communications mean nothing if the pilot cannot effectively engage the required target in the objective area.

An Attack Helicopter Commander must be proficient at fighting his or her aircraft, day or night, feet wet or dry, under varying threat conditions. An AHC incapable of employing his or her organic weapons systems effectively does not contribute to the overall combat readiness of the squadron, limits a MAGTF Commander's flexibility on the battlefield, and erodes the versatility of the community. The AH-1W community must prioritize pilot training from the target out in a similar fashion as it conducts detailed mission planning:

1. Train to **hit** the target (with all organic weapons systems)
2. Train to **find** the target (in the objective area)
3. Train to **navigate** to the target
4. Train to **communicate** to the target
5. Train to **synchronize** target engagements with multiple assets

The T&R must support both guided and unguided weapons employment training. Squadron training officers cannot expect pilots to progress based assumptions that they will get more range time during last minute frags or external training support. The T&R alone must provide the required framework and structure to train to the necessary proficiency level mandated by standards. Hence, the following T&R revisions are recommended:

1. Establish effective, consistent performance standards for unguided weapons employment (see recommended performance standards)

2. Increase the Core Basic Phase Specific Weapons Delivery syllabus by three training events; these events should be rear seat events, at least two hours in duration, focusing on basic employment of rocket and 20mm cannon; these training events should not contain any complex tactical scenario; the last training event should be conducted on a scored range in order to properly asses the students progression toward meeting performance standards

3. Increase the Core Advanced Phase by adding five Specific Weapons Delivery training events (providing a more balanced training phase with an SWD stage receiving as much training focus as the OAS stage); these events should be rear seat events, at least two hours in duration, focusing on basic employment of rocket and 20mm cannon; these training events should not contain any complex tactical scenario; the last training event should be conducted on a scored range in order to evaluate the students ability to meet performance standards

CONCLUSION

The rocket system would not be optimum when compared to special purpose weapons (guided, anti-tank missiles) or to large, heavy weapons (Advanced Bomb Family), but would represent to the enemy a system that could kill them and to friendlies a system which could protect them and respond quickly in desperate situations.[44]

Rex Randolph, 1990

The preceding research attempted to examine two key questions concerning the AH-1W community. First, is the current Training and Readiness Manual properly designed to produce effective attack pilots with the requisite unguided weapons employment skills needed in current and future conflict? Second, by what measure are those skills evaluated in order to ensure minimum standards are achieved throughout the community?

No training syllabus is perfect. The proper balance between costly requirements and limited resources is always an issue. The requirements to train an effective attack pilot (ordnance allocation, flight hours, maintenance hours, etc.) should be analyzed initially without consideration of potentially limited resources. A lack of resources does not change the requirement; it forces one to prioritize training to those skills critical to mission accomplishment. The attack helicopter

mission is at times a fast paced, complex, and unforgiving one. Responding to urgent calls for support, in the midst of a chaotic situation, with an enemy more than willing to provide his vote, simply necessitates minimal error. When the time comes to pull the trigger, there can be no lack of confidence in the training received.

The current T&R Manual is not a broken or completely ineffective document. It merely lacks the needed focus on critical skills required to perform the attack helicopter mission. Weapons employment training, both guided and unguided, should dominate the training events contained in the T&R. The rocket trend analysis presented in this research should shock those within the AH-1W community. How did we get to a point where at a range of 300 to 1,000 meters, the average PWTI cannot put a rocket within half a football field of his intended target? Clearly, the T&R must provide a more structured and robust weapons employment syllabus.

The results of increased training will not show the desired improvement unless the community begins to believe its own rhetoric. The Air NTTP preaches the need for constant and consistent training in order to ensure accurate weapons employment, but the T&R provides no framework to translate those lessons learned into practice. The T&R talks of establishing "performance standards to ensure aircrew maintain a common base of training and a depth of combat capabilities;"[45] however, fails to do so in any consistent manner in its own document.

Establishing consistent and effective performance standards, designing a T&R that fully supports training to them, and adhering to the standard is the only way to achieve an improvement in weapons employment capabilities. Technology can and will improve accuracy in the near term, but proceed with caution. Systems go down, lasers fail, weather rolls in, and the threat changes. Versatility is about being able to effectively employ the AH-1W in all of those situations. It is versatility, after all, that ensures the AH-1W remains relevant for the foreseeable future.

ENDNOTES

1. Lieutenant Colonel Lawrence E. Casper, "The Strong Case for Not Cutting the 2.75 Rocket," *ARMY* 42, no. 2 (February, 1992): 48.

2. Secretary of the Navy, *Combat Aircraft Fundamentals - AH-1W (U), Air NTTP 3-22.3-AH-1W* (Washington, DC: Department of the Navy, July 2007), 3-22.

3. Secretary of the Navy, *Combat Aircraft Fundamentals - AH-1W (U), Air NTTP 3-22.3-AH-1W* (Washington, DC: Department of the Navy, July 2007), 1-1.

4. Major Mark H. Bamberger, "Are Non-Precision Munitions a Viable Weapon for Attack Helicopters?" (master's thesis, U.S. Army Command and General Staff College, June 1, 1992), 14.

5. Deputy Commandant for Aviation, *2007 Marine Aviation Plan* (Washington, DC: Headquarters Marine Corps, June 1, 2007), 9-2.

6. Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, NY: Cornell University Press, 2000), 36.

7. Lambeth, 42.

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9. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Manual, AH-1, MCO 3500.48A,* December 20, 2004, 3.

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11. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 2007, 6-6.

12. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 2007, 1-8.

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15. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 2007, 37.

16. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 2007, 45.

17. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 2007, 9.

18. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 2007, 50.

19. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 2007, 58.

20. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 200758.

21. Major Thomas A. Budrejko, *Questionnaire: Unguided Weapons Employment and the T&R* (Virginia: United States Marine Corps Command and Staff College, 2007).

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23. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Manual, AH-1, MCO 3500.48A,* December 20, 2004, 3.

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25. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Program Manual, NAVMC 3500.14,* July 3, 2007, 48.

26. Secretary of the Navy, *Combat Aircraft Fundamentals - AH-1W (U), Air NTTP 3-22.3-AH-1W* (Washington, DC: Department of the Navy, July 2007),, 3-33.

27. MCAS Yuma Range Management, *Cactus West (R-2301W),* <http://www.yuma.usmc.mil/services/range/ranges/cactuswe.htm> (12 December 2007).

28. It is important to note that the data provided is not without limitations. First, individual student data is not available until WTI Class 1-03. Second, the researcher has been unable to obtain the raw data (individual rocket shot bearing and distance from target) compiled by the MAWTS-1 AH-1W Cobra Division. Third, the data represents a relatively small percentage of the AH-1W pilot population who have attended the WTI Course; a *graduate level* instructor qualification course with an experienced student population. Fourth, the data does not include any information for 20mm cannon employment. Still, the data remains useful in identifying general trends within the AH-1W community.

29. During classes 2-00 through 2-07, AH-1W instructors imposed the following restraints on the PWTI: comply with established minimum break distance, comply with range run-in heading of 140° magnetic, and each student fires seven 2.75" Inert Rockets. WTI Class 1-08 received the following restraints in addition to those stated above: students must comply with the newly established Weapons Release Envelope (see Appendix O), attack profile entry is at the discretion of the PWTI, and the specific dive angle is at the discretion of the PWTI (between 10° and 30°).

30. Again, due to a lack of individual student data from WTI Class 2-00 through 2-02, the high and low average miss distance trend lines appear exaggerated during those classes.

31. Secretary of the Navy, *Combat Aircraft Fundamentals - AH-1W (U), Air NTTP 3-22.3-AH-1W* (Washington, DC: Department of the Navy, July 2007),, 3-33.

32. Secretary of the Navy, *Combat Aircraft Fundamentals - AH-1W (U), Air NTTP 3-22.3-AH-1W* (Washington, DC: Department of the Navy, July 2007),, 3-33.

33. Headquarters U.S. Marine Corps, *Operational Terms and Graphics, MCRP 5-12A* (Washington, DC: U.S. Marine Corps, September 21, 2004), 1-180.

34. Headquarters U.S. Marine Corps, *Operational Terms and Graphics, MCRP 5-12A* (Washington, DC: U.S. Marine Corps, September 21, 2004), 1-180.

35. Office of the Chief of Naval Operations, *AH-1W Naval Aviation Technical Information Product, NTRP 3-22.4-AH-1W* (Washington, DC: Department of the Navy, March 21, 2003), 1-18.

36. Secretary of the Navy, *Combat Aircraft Fundamentals - AH-1W (U), Air NTTP 3-22.3-AH-1W* (Washington, DC: Department of the Navy, July 2007), 3-33.

37. Commandant of the Marine Corps, *Universal Naval Task List (UNTL), MCO 3500.26A,* January 30, 2007, 4-B-100.

38. Major Thomas A. Budrejko, "Weaponeering," *The Skid Newsletter* (September 1, 2007), 3.

39. *Department of Defense Dictionary of Military and Associated Terms, Joint Publication 1-02,* (2001), 372.

40. Are the recommended performance standards for 20mm cannon effective? There is a tendency to translate all weapons standards into a distance measurement on the ground. In most circumstances, that technique is indeed the most effective. That distance measurement, however, must support the tactical task forming the basis for the standard (i.e. destruction, neutralization, suppression, etc.). For example, establishing 20mm engagement standards based on the criteria of neutralization and then setting the performance standard at 5 meters is not effective. A pilot simply cannot neutralize a target with 20mm if he or she cannot hit the target. Rounds must impact the target in order to have any effect other than suppression. Hence, timing is the only effective means of evaluating pilot proficiency in this skill. If actually hitting the target is a given, instructors must

then assess pilot proficiency by noting how long it takes that individual pilot to put rounds on the target.

Are the recommended performance standards for 20mm cannon reasonable? Like the recommended rocket standard, this recommendation is no small challenge. Achieving such a standard requires focus and dedication from both the pilot under instruction and the instructor. The root of consistency and accuracy in weapons employment lies in constant practice and forming repeatable habits. As with rocket employment, there are aircraft barriers to accuracy such as M197 20mm cannon reliability, boresight errors, and malfunctions. To be effective with this weapon system, however, pilots must learn to overcome inherent limitations and place rounds on target.

41. Headquarters U.S. Marine Corps, *Operational Terms and Graphics, MCRP 5-12A* (Washington, DC: U.S. Marine Corps, September 21, 2004), 1-180.

42. Major Thomas A. Budrejko, *Questionnaire: Unguided Weapons Employment and the T&R* (Virginia: United States Marine Corps Command and Staff College, 2007).

43. Major Richard B. Ashford, *Questionnaire: Unguided Weapons Employment and the T&R* (Virginia: United States Marine Corps Command and Staff College, 2008).

44. Rex Randolf, *Rocket Need Statement* (China Lake, CA: Naval Weapons Center, Code 3517, December, 1990), 1.

45. Commandant of the Marine Corps, *Aviation Training and Readiness (T&R) Manual, AH-1, MCO 3500.48A,* December 20, 2004, 3.

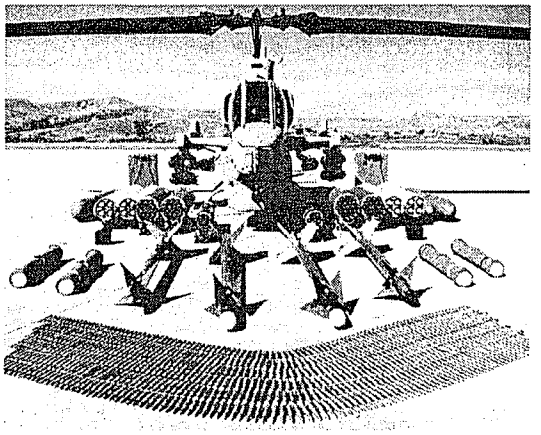
APPENDIX A: AH-1W GENERAL DESCRIPTION

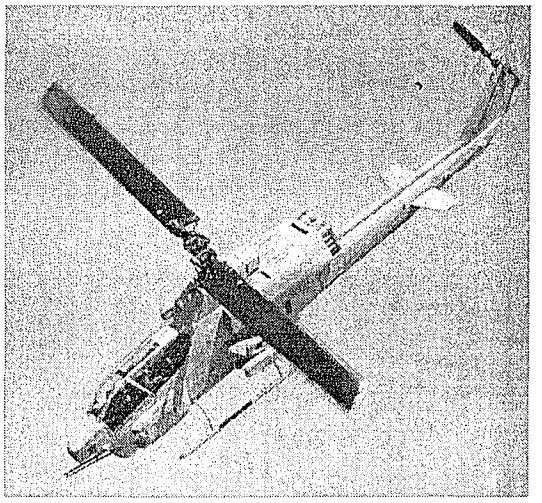
Sources: Naval Air Systems Command, PMA-276 USMC Light / Attack Helicopter Program Office, AH-1W Fact Sheet, http://pma276public.navair.navy.mil/pma276public/factSheets.asp (accessed February 23, 2008).

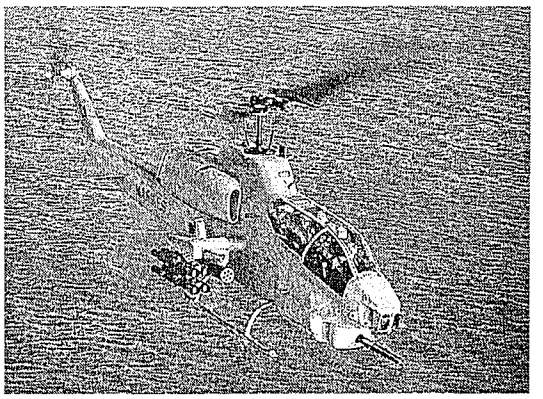
Service: United States Marine Corps

Description: Attack helicopter

Mission: The AH-1W *Super Cobra* helicopter is used by the Marine Corps for close air support (CAS), armed escort and armed reconnaissance.







AH-1W General Characteristics

Contractor: Bell Helicopter Company
Power Plant: Two General Electric T700-GE-401 turboshaft engines, 3,380 hp (2,520 kw)
Length: 58 feet, 0 inches (17.7 meters)
Width: 48 feet (14.6 meters) with rotors spread, 11 feet (3.4 meters) with rotors fore and aft.
Height: 14 feet 5 inches (4.4 meters)
Empty Weight: 6,000 pounds (2,721.5 kg)
Maximum Takeoff Weight: 10,500 pounds (4,762.7 kg)
Mission Radius: 58 nautical miles (107.4 km)
Maximum Cruise Speed: 110 kts (203.7 km/hr)
Ceiling: 17,300 feet (5,273 meters)
Crew: Pilot, Copilot/Gunner
Armament:
2.75-inch rocket pods, 5-inch Zuni rockets, GPU-2A 20mm gun pods, Hellfire missiles, TOW missiles, AIM-9 Sidewinder missiles, M197 20mm automatic gun
Introduction date: March, 1986

Background: Originating from a concept demonstrator delivered to the U.S. Army in 1962 that was based upon a UH-1 *Iroquois*, the AH-1 is the world's first true helicopter gunship. When the U.S. Army first employed the AH-1G *Cobra* in combat in Vietnam in 1967, it quickly validated the concept of the tandem cockpit design, which is standard on virtually all attack helicopters. The Marine Corps quickly realized the *Cobra's* potential in littoral warfare and deliveries of the twin-engined AH-1J began in 1968. Since that time, the AH-1 has provided close air support and armed reconnaissance for Marines in every clime and place the Nation has called on them to protect national interests, including Beirut, Grenada, Panama, Operation Desert Storm, Somalia, Haiti, the Balkans and most recently in Afghanistan. Marines have been flying the current version, the AH-1W *Super Cobra*, since 1986 when the flying Leathernecks of Camp Pendleton's (California) HMA-169 (now HMLA-169), MAG-39, 3rd MAW were first introduced to it. The last AH-1W Super Cobra was delivered to the Marine Corps July 31, 1998.

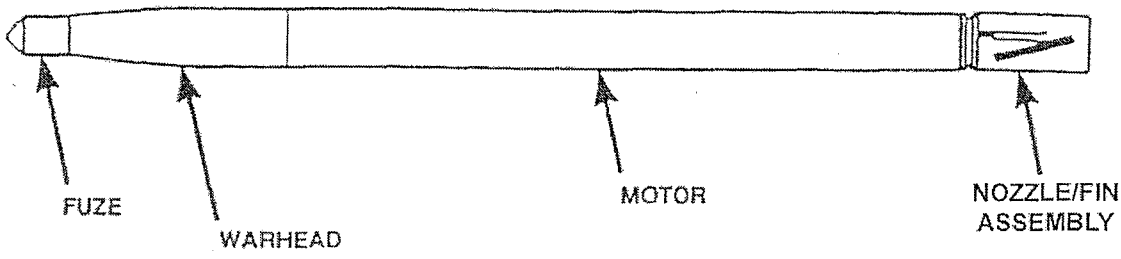
The AH-1W *Super Cobras* are fielded in Marine Light Attack Helicopter Squadrons, or HMLA's, along with the UH-1N *Iroquois*. Detachments from HMLAs deploy as part of the task-organized Aviation Combat Element of a Marine Air-Ground Task Force, the most common of which is the Marine Expeditionary Unit, or MEU.

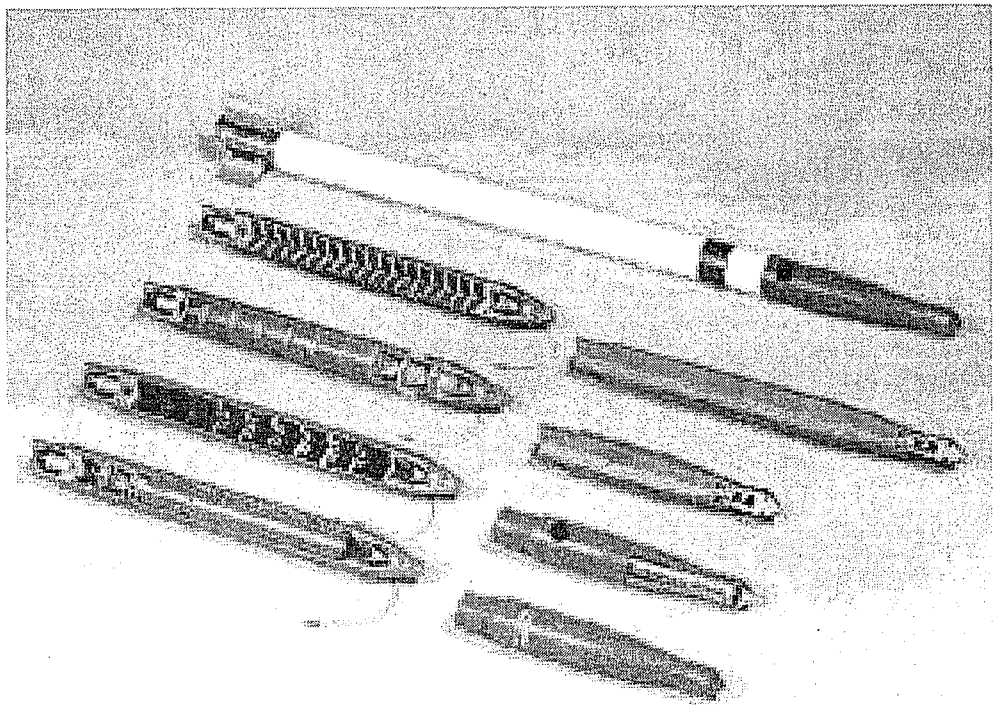
ROCKET: GENERAL CHARACTERISTICS

Source: Office of the Chief of Naval Operations, *AH-1W Naval Aviation Technical Information Product, NTRP 3-22.4-AH-1W* (Washington, DC: Department of the Navy, March 21, 2003), 1-11 to 1-27.

Rockets:

The 2.75-inch and 5.00-inch aircraft rockets, with the selection of warheads available, provide an effective attack capability against a variety of targets. An aircraft rocket system consists of a multi-tube jettisonable launcher loaded with assembled rockets mated to the aircraft station and armament circuitry. Conventional aircraft rockets have an unguided boost phase and a ballistic flight phase. The motor provides a high impulse over a short period of time and consists of a high-strength tube closed at the forward end, a propellant grain, an igniter assembly, and a fin and nozzle assembly. Wraparound fins allow multiple rockets (up to 19), dependent on launcher used, to be carried on each authorized station. Warhead types include high explosive fragmentation, smoke, illumination, flechette, and inert practice.





Picture Source: http://images.google.com/imgres?imgurl=http://www.fas.org/man/dod-101/sys/missile/kphydra.jpg&imgrefurl=http://www.fas.org/man/dod-101/sys/missile/hydra-70.htm&h=232&w=300&sz=12&hl=en&start=5&um=1&tbnid=v9Prg738uoFSLM:&tbnh=90&tbnw=116&prev=/images%3Fq%3D2.75%2Brockets%26um%3D1%26hl%3Den%26sa%3DN

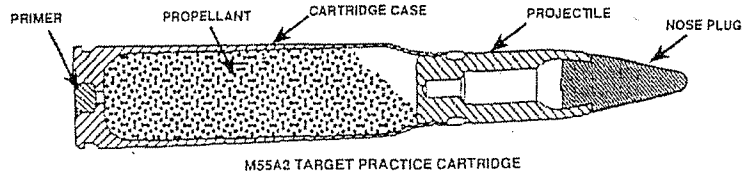
20mm: GENERAL CHARACTERISTICS

Source: Office of the Chief of Naval Operations, *AH-1W Naval Aviation Technical Information Product, NTRP 3-22.4-AH-1W* (Washington, DC: Department of the Navy, March 21, 2003), 1-1 to 1-10.

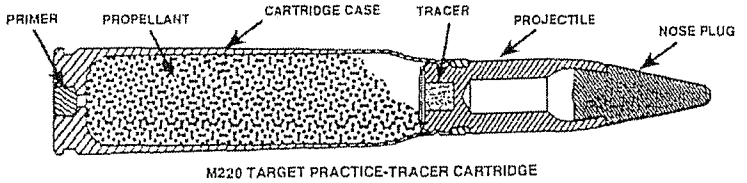
20mm Cannon:

A 20-mm round consists of steel or brass cartridge case, an electric primer, propellant powder, and the projectile. The primer is ignited by 28-Vdc electrical power from the aircraft armament system. The primer ignites the propellant powder that forms a gas as it burns, forcing the projectile through the gun barrel. There are two configurations of ammunition (M50 series / PGU), the only significant difference being the projectile. Three general projectile types are available: high explosive incendiary tracer (HEI), target practice (TP), and target practice tracer (TP-T).

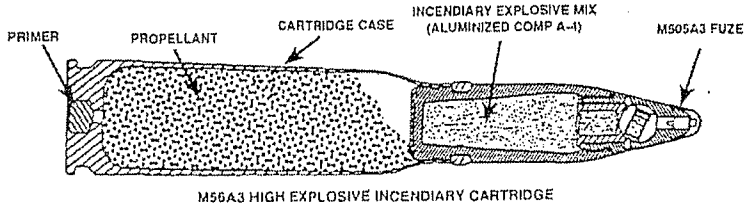
The M50 series ammunition was designed for high-altitude, air-to-air combat. The ammunition is deficient in the air-to-ground mission because of poor ballistic performance at low altitudes; the inability to penetrate lightly armored ground targets; and a high dud rate.



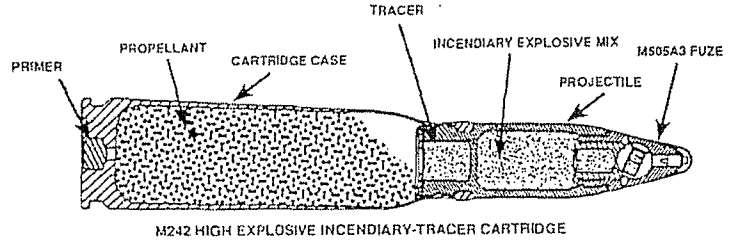
M55A2 TARGET PRACTICE CARTRIDGE



M220 TARGET PRACTICE-TRACER CARTRIDGE

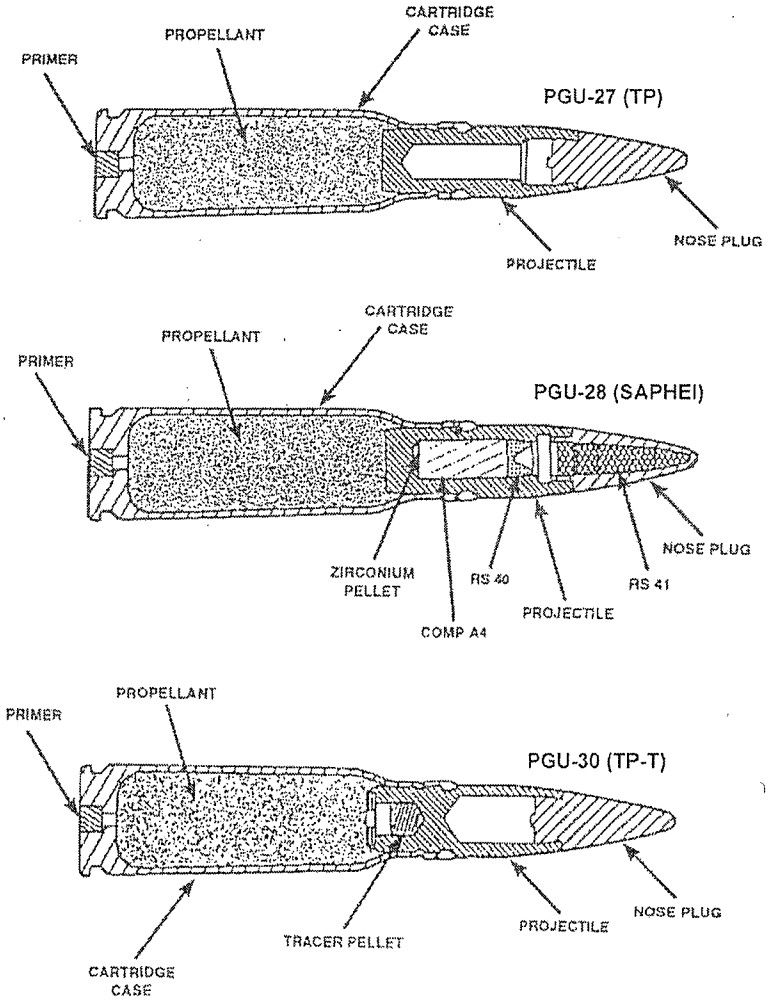


M56A3 HIGH EXPLOSIVE INCENDIARY CARTRIDGE



M242 HIGH EXPLOSIVE INCENDIARY-TRACER CARTRIDGE

The PGU series is multipurpose ammunition developed to be more effective in the air-to-ground mission. The 20-mm PGU SAPHEI projectile is more effective than the M50 series ammunition projectile. The SAPHEI projectile is a combination of a hardened steel body and pyrotechnic fuze that allows the projectile to penetrate and detonate inside the target. The detonation ignites a zirconium pellet providing a long, persistent spark for improved fire-starting capability. The streamlined projectile reduces the projectile drag coefficient and allows better pyrotechnic ignition resulting in improved graze sensitivity and fewer duds. All PGU projectiles are ballistically the same.



APPENDIX B: AH-1W Core METL

Source: MCO 3500.48A Aviation Training and Readiness (T&R) Manual, AH-1 (page 3)

AH-1 Mission Essential Task List (METL)

A. Conduct Shipboard Deck helicopter Landing Qualifications
B. Conduct Sea and Air Deployment Operations
    - Maintain the capability to deploy and operate from advanced bases, expeditionary airfields, Forward Operating Bases (FOBs), and naval shipping
    - Perform organizational maintenance on assigned aircraft
C. Conduct Air Assault Operations and Air Assault
    - Provide armed escort for assault helicopters and tiltrotor aircraft
D. Conduct Amphibious Assault and Raid Operations
    - Provide armed escort for airborne and surface forces
E. Conduct Fire Support
    - Engage and destroy point armored targets
    - Provide fire support for forward and rear area forces against point and area targets
F. Conduct Close Air Support
    - Conduct escort of friendly ground forces
    - Conduct Assault Support Escort
G. Conduct Interdiction Operations
    - Conduct armed reconnaissance
H. Conduct Joint Suppression of Enemy Air Defenses
I. Conduct Air-to-Air Operations
    - Conduct offensive anti-air warfare and defensive air operations
    - Maintain self-defensive capability from air-to-air threats
J. Coordinate Battlespace Maneuver and Integrate with Firepower
    - Conduct combined arms coordination and control operations
    - Conduct multi-sensor imagery, visual reconnaissance, and provide Battle Damage Assessment
K. Conduct Joint Personnel Recovery
    - Conduct Tactical Recovery of Aircraft and Personnel (TRAP) operations
L. Conduct Rear Area Security
    - Provide security for forward and rear area forces against point and anti-armor forces
M. conduct Noncombatant Evacuation
    - provide Fire Support and escort for evacuation operations

* Core Mission Essential Task List (METL): The Core METL is a standardized list of tasks for which a unit designed and organized.

APPENDIX C: METL / Core Skill Matrix

Source: MCO 3500.48A Aviation Training and Readiness (T&R) Manual, AH-1 (page 5)

METL / Core Skill Matrix: AH-1W core skills directly support the METL as follows:

	AH-1 CORE SKILL									CORE PLUS	
METL	TERF	REC	SWD	ESC	OAS	ANSQ	FAC	EW	CQ	DACM	NBC
a. Conduct Shipboard Deck helicopter Landing Qualifications						X			X		X
b. Conduct Sea and Air Deployment Operations						X			X		
c. Conduct Air Assault and Air Assault Operations	X		X	X	X	X	X	X	X	X	X
d. Conduct Amphibious Assault & Raid Operations	X	X	X	X	X	X	X	X	X	X	X
e. Conduct Fire Support	X	X	X		X	X	X	X			X
f. Conduct Close Air Support	X	X	X		X	X	X	X			X
g. Conduct Interdiction Operations	X	X	X		X	X	X	X			X
h. Conduct JSEAD	X	X	X		X	X	X	X			X
i. Conduct Air-to-Air Operations	X		X	X		X		X		X	X
j. Coordinate Battlespace Maneuver and Integrate w/ Firepower	X	X	X		X	X	X				X
k. Conduct Joint Personnel Recovery	X	X	X	X	X	X	X				X
l. Conduct Rear Area Security	X	X	X	X	X	X	X	X		X	X
m. Conduct Noncombatant Evacuation	X	X	X	X	X	X	X	X			

APPENDIX D: AH-1W Core Skill Description

Sources: The following information contains direct excerpts from MCO 3500.48A Aviation Training and Readiness (T&R) Manual, AH-1; Air NTTP 3-22.3-AH-1W Combat Aircraft Fundamentals – AH-1W (U); and the MAWTS-1 Forward Air Controller (Airborne) Handbook.

TERF: **Terrain Flight** (TERF) is the employment of aircraft flight profiles in such a manner as to utilize terrain, vegetation, and man-made objects to enhance survivability by degrading the enemy's ability to visually, optically, aurally, and electronically acquire and target the aircraft. It involves a constant awareness of the positions and capabilities of enemy weapon and acquisition systems in relation to the route of flight and en route terrain. TERF encompasses those tactical flights in which the intent is to fly at or below 200 feet AGL, using low-level, contour, and NOE techniques.

Core Introduction Phase (100 Level) TERF Stage:

Purpose: To introduce low level, contour, and nap of the earth (NOE) mode of TERF flight and develop proficiency in the application of TERF procedures.

General: PUI will demonstrate an understanding of the TERF modes (low level, contour, and NOE) and proficiency in low level, contour, and NOE flight maneuvers. PUI will also demonstrate a basic knowledge of current threat systems and their applicability to TERF. PUI will compute weight and balance prior to each sortie. PUI will also demonstrate a solid knowledge of GPS/EGI operations and use of the MDL if installed.

Core Basic Phase (200 Level) TERF Stage:

Purpose: To refine proficiency in terrain flight and navigation.

General: PUI will be TERF qualified prior to proceeding to follow-on stages, not to include simulator events. PUI will demonstrate proficiency in terrain flight and navigation. Once complete in this stage the pilot may be TERF qualified (QUAL-610) in writing at the discretion of the commanding officer.

REC: **Reconnaissance.** HMLAs may conduct reconnaissance missions in support of both ground and aviation units. Per MCWP 3-26, *Air Reconnaissance*, there are ten types of air reconnaissance. Of those, an HMLA will normally be tasked with four: area, specific, route, and HLZ reconnaissance.

1. **Area reconnaissance** is the directed effort to obtain detailed information on all routes, terrain, and enemy forces within a specific area defined by boundaries. The purpose may be to locate enemy and/or suitable routes of advance for main elements (ground or air).

2. **Point specific reconnaissance** is used when intelligence is required about a specific point in the operating area. A specific reconnaissance mission is assigned when the commander desires information on a town, ridgeline, woods, or other features that may be critical to the

operation. The specific point to be reconnoitered is designated by use of a boundary line completely enclosing the point. With the exception of movement to and from the area, a point reconnaissance is conducted in the same manner as an area reconnaissance. The point and controlling terrain must be thoroughly reconnoitered. An air unit may perform a point reconnaissance forward of friendly lines when the situation is fluid or an open or lightly defended flank exists. Emphasis normally is placed on reaching the area quickly. Different routes are used for the return flight to make it more difficult for the enemy to ambush returning aircraft. Routes to and from the area are selected after an analysis of the enemy situation and terrain.

3. **Route reconnaissance** is obtaining information along a specific route and the terrain adjacent to the route that, if occupied or utilized by the enemy, would affect the tactical situation. A route reconnaissance may be requested to obtain information of a specific route or of an enemy force moving generally along a specific route. When intelligence indicates that the enemy is moving on one or more routes, or when terrain features channelize the advance, these routes should be reconnoitered to obtain enemy information. Routes of advance or flight routes may be reconnoitered when specific information of the route is required for the movement of friendly forces. Detailed route reconnaissance may be performed in conjunction with ground reconnaissance elements, especially when the route traverses densely vegetated or built-up areas.

4. **Helicopter Landing Zone Reconnaissance.** Selecting LZs for assault aircraft requires gathering as much information in as little time as possible. Normally, the information is sent by radio to an en route assault flight that is expecting confirmation of a certain LZ. Because of the tactical situation or the need for security, time may be a factor. Therefore, the desired information must be collected rapidly while flying over the area only once or twice or observing the LZ from a distance. This goal can be reached only through constant practice and until the maximum amount of detail can be obtained in progressively shorter periods of time. Procedures for selecting sites and zones to be used as pickup areas, landing zones, and tactical heliports or airfields are the same.

Core Basic Phase (200 Level) REC Stage:

Purpose: To develop proficiency in reconnaissance operations.

General: The PUI will demonstrate proficiency in aircraft system employment for target detection, recognition and identification during reconnaissance operations. Emphasize sensor management during reconnaissance operations for target detection, recognition and identification.

ESC: **Escort.** The speed and maneuverability provided by assault helicopters are of tremendous advantage to the MAGTF commander. However, left unprotected, these helicopters can become a significant liability. Assault support planners must be able to tactically and efficiently employ all fire support means available to protect these important assets during the en route and terminal phases of helicopterborne operations. The purpose of escort is to destroy, neutralize, or suppress a given threat before that threat is able to influence the escorted package. Ideally, the goal is to proactively engage targets and allow the escorted package to proceed unhindered to their objective. However, AH-1Ws must also retain a reactive capability to respond to threats that appear within the assault package itself.

Core Basic Phase (200 Level) ESC Stage:

Purpose: To develop proficiency in prescribed heliborne or surface escort formations and maneuvers.

General: The pilot will develop a working knowledge of escort formations, maneuvers and techniques associated with heliborne operations. Ordnance is optional for this stage of training. If ordnance is utilized, the PUI shall have completed the SWD flight corresponding to the ordnance load.

SWD: **Specific Weapons Delivery**. The purpose of SWD training is to develop the proper fundamentals of weapons delivery and does not correlate to a specific tactical mission (such as Escort, Reconnaissance, or Offensive Air Support). The skills developed during SWD training apply to nearly all Core METLs.

Core Introduction Phase (100 Level) SWD Stage:

Purpose: To develop the ability to deliver air-to-ground weapons employing all available sensors and weapons systems. IP will stress error analysis and multiple sensor usage during weapons delivery.

General: At the completion of this stage, PUI will demonstrate proficiency in all ordnance delivery techniques. A LASER safe range is required for the NTS LASER designator and range finder. TOW plugs and captive HELLFIRE will be used to the maximum extent possible to exercise weapons switchology and symbology.

Core Basic Phase (200 Level) SWD Stage:

Purpose: To develop proficiency in SWD and weapon systems employment.

General: At the completion of this stage, the PUI will have displayed proficiency at delivering ordnance and proper use of the NTS under all threat conditions with mixed ordnance loads. Emphasis will be on CRM while utilizing the ordnance systems.

OAS: **Offensive Air Support** (OAS) is a critical tool used by the MAGTF commander in order to accomplish mission objectives. As part of a combined arms team, OAS plays an important role in shaping the battlefield. The two categories of Marine OAS are close air support (CAS) and deep air support (DAS). For further discussion of OAS, refer to MCWP 3-23 series.

Core Basic Phase (200 Level) OAS Stage:

Purpose: To develop proficiency in OAS under varying threat conditions.

General: The PUI will display proficiency in RW CAS in support of a ground unit.

Core Advanced Phase (300 Level) OAS Stage:

Purpose: To develop the procedures and skill to tactically employ the aircraft during CAS and AI missions.

General: Upon completion of this stage the pilot will be proficient in the planning, briefing and execution aspects of CAS and AI missions. In addition, the pilot will be proficient in the operation and employment of all organic weapon systems. Other OAS missions (AR, SCAR) will be trained to in the Full Combat Qualification phase.

ANSQ: **Advanced Night System Qualification**. The ANSQ stage of training is designed to qualify the PUI to perform various tactical missions and tasks during Low Light Level conditions.

Core Advanced Phase (300 Level) ANSQ Stage:

Purpose: To develop proficiency during LLL operations.

General: At the completion of this stage, the PUI will be able to effectively employ the AH-1W during LLL conditions. Once complete in this stage, and designated NSQ (LLL) by the squadron commanding officer, the PUI may complete the remaining combat qualification NVD training under any light level conditions.

EW: **Electronic Warfare**. Although radar-guided threat systems are not as widely proliferated as EO/IR and optically guided systems, they are quite lethal. Defeating these systems requires a working knowledge of basic radar principles.

Core Advanced Phase (300 Level) EW Stage:

Purpose: To introduce offensive/defensive electronic countermeasures, tactics, employment of Aircraft Survivability Equipment (ASE) and employment of precision guided munitions in an EW environment.

General: An EW range and/or a TRTG/threat simulator shall be used. Use of a ship's radar system or MACCS facility may be substituted for non-simulator events.

FAC: **Forward Air Controller (Airborne).** The FAC(A) is a specifically trained and qualified aviation officer who exercises control from the air of aircraft engaged in CAS of ground troops. The FAC(A) is normally an airborne extension of the TACP. The FAC(A) can serve as another terminal attack controller for the TACP and extend the acquisition range of a tactical air control party. FAC(A) tasks include detecting and destroying enemy targets, coordinating target marking, providing terminal attack control of CAS missions, conducting air reconnaissance, providing artillery and naval gunfire air spotting, providing radio relay for the TACP or JTAC, and passing BDA. A FAC(A) must be able to coordinate supporting arms missions and CAS missions. The FAC(A) will execute the Commander's Intent in all weather conditions. To accomplish this, the FAC(A) must conduct detailed planning and integrate with the supported maneuver element.

Core Advanced Phase (300 Level) FAC Stage:

Purpose: To qualify PUI as a FAC(A) in accordance with applicable directives.

General: At the completion of this stage, the PUI will have demonstrated a thorough knowledge of the FAC(A) procedures used to control FW aircraft and supporting arms under varied environmental and threat conditions. At the completion of this stage the PUI may be designated a FAC(A) by the squadron commanding officer and will be assigned the Tracking Code of QUAL-624. For pilots returning directly from FAC tours, this stage may be abbreviated by the commanding officer based upon the pilot's terminal controller experience level. An aircraft control for the purpose of defining requirements is a mission that ends with a "cleared hot," "continue dry," or "abort" issued from the terminal controller. Credit for each control will go to both pilots.

APPENDIX E: Core Introduction Phase (100 Level)

Source: Extract from MCO 3500.48A (pages 37-39): T&R syllabus events relevant to weapons employment

8. Specific Weapons Delivery (SWD)

a. Purpose. To develop the ability to deliver air-to-ground weapons employing all available sensors and weapons systems. IP will stress error analysis and multiple sensor usage during weapons delivery.

b. General. At the completion of this stage, PUI will demonstrate proficiency in all ordnance delivery techniques. A LASER safe range is required for the NTS LASER designator and range finder. TOW plugs and captive HELLFIRE will be used to the maximum extent possible to exercise weapons switchology and symbology.

c. Crew Requirements. As listed at the end of each event.

d. Ground/Academic Training. SWD stage lecture, ICW on BCWD and applicable chapters of the AH-1W NATOPS and TACMAN.

e. Flight and Simulator Event Training. (3 Sorties, 6.0 Hours/3 Simulator Periods, 4.5 Hours).

SSWD-160 1.5 C,R WST / S

Goal. FS - Introduce Cobra weapon systems.

Requirement

(1) Discuss arm/dearm checklist, after arming checklist and NTS operations.

(2) Introduce use of THCDP and NTS, turret hover fire and running fire using the MFD, TSU and HSS, all modes of HELLFIRE and TOW operations and constraints associated with CCDTV/DVO and FLIR. Emphasize NTS and weapons switchology, checklists and crew coordination.

(3) Review 20 and 30 degree dives.

Performance Standards. Per the AH-1W NATOPS, TACMAN and MDG.

Prerequisites. FAM-109.

Ordnance. N/A.

External Syllabus Support. N/A.

Crew. CSI/PUI.

SWD-161 2.0 C 2 AH-1W A

Goal. FS - Introduce SWD gunnery.

Requirement

(1) Discuss PGU series ammunition, cocking checklist, runaway gun, armament preflight, telescopic sight unit, turret system, HSS operations, LASER system, post firing/before landing checklist, after dearm checklist, pilot override, boresight and turret malfunctions.

(2) Demonstrate a range brief and range sweep.

(3) Introduce arm/dearm checklists/procedures, all modes of turret operation, THCDP/NTS operations. Emphasize ICS communication and crew coordination.

(4) Review turret fire and NTS switchology.

Performance Standards. Per the AH-1W NATOPS, TACMAN and MDG.

Prerequisites. SSWD-160.

Ordnance. 400 rounds 20mm.

External Syllabus Support. Live fire range.

Crew. WTO/PUI.

SSWD-162 1.5 C,R WST S

Goal. RS - Introduce weapon systems.

Requirement

(1) Discuss NARCADS and ordnance emergencies.

(2) Introduce hover and running fire, rocket delivery using hover, running, pop-up and 20/30 degree diving fire.

(3) Review TOW and HELLFIRE associated procedures and constraints and switchology. Emphasize front and rear seat switchology inter-relationships and crew coordination.
Performance Standards. Per the AH-1W NATOPS, TACMAN and MDG.

Prerequisites. FAM-109.

Ordnance. 400 rounds 20mm.

External Syllabus Support. N/A.

Crew. CSI/PUI.

SWD-163 2.0 C 2 AH-1W A

Goal. RS - Review SWD gunnery.

Requirement

(1) Discuss rocket motors, fuses and warheads, rocket/gun reticles, Heads Up Display (HUD), rocket delivery to include delivery/frag pattern charts, 20mm cannon delivery and error analysis.

(2) Review rocket and turret delivery from diving and running fire with emphasis on weapon systems operation, all related emergencies, cleared hot procedures and range brief.

Performance Standards. Per the AH-1W NATOPS, TACMAN and MDG.

Prerequisites. SWD-162.

Ordnance. 200 rounds 20mm, 7 x 2.75 inch rockets, 4 x 5.00 inch rockets.

External Syllabus Support. Live fire range.

Crew. WTO/PUI.

SWD-164 2.0 C,E 2 AH-1W A

Goal. RS – Weapon systems evaluation.

Requirement

(1) Discuss gunner armament control panel, helmet sighting system, gunner sight hand control, target acquisition, range estimation and WERM rule.

(2) Review rocket and turret hover fire, rocket and turret running fire, weapon system operation and all related emergencies. PUI will demonstrate a CEP of 15 meters from turret fire if manned range is available. Emphasize range sweep, target I.D. and crew coordination. PUI will conduct a range brief.

Performance Standards. Per the AH-1W NATOPS, TACMAN and MDG.

Prerequisites. SWD-163.

Ordnance. 200 rounds 20mm, 12 x 2.75 inch rockets.

External Syllabus Support. Live fire range.

Crew. WTO/PUI.

SSWD-165 1.5 C,R,M WST S

Goal. FS - Weapons review.

Requirement

(1) Discuss TOW Missile System (TMS), TMS Built-In Test, HELLFIRE missile system and weapons envelopes. PUI will emphasize weapons system integration, weapon delivery envelopes and front seat ordnance emergencies.

(2) Review crew coordination and all modes of TOW and HELLFIRE operation.

Performance Standards. Per the AH-1W NATOPS, TACMAN and MDG.

Prerequisites. SWD-164.

Ordnance. N/A.

External Syllabus Support. N/A.

Crew. CSI/PUI.

APPENDIX F: Core Basic Phase (200 Level)

Source: Extract from MCO 3500.38A (pages 45-52): T&R syllabus events relevant to weapons employment

7. Specific Weapons Delivery (SWD)

a. Purpose. To develop proficiency in SWD and weapon systems employment.

b. General. At the completion of this stage, the PUI will have displayed proficiency at delivering ordnance and proper use of the NTS under all threat conditions with mixed ordnance loads. Emphasis will be on CRM while utilizing the ordnance systems.

c. Crew Requirements. As listed at the end of each event.

d. Ground/Academic Training. IAW the MAWTS-1 Course Catalog.

e. Flight and Simulator Event Training. (4 Sorties, 8.0 Hours/2 Simulator Periods, 3.0 Hours).

SSWD-240 1.5 C,R WST/APT S

Goal. FS - To develop proficiency using TOW and HELLFIRE missile systems.

Requirement

(1) Discuss pre/post-launch constraints, designation/delay options, cloud ceiling limitations, J-LASER terminology, JMEMs, SDZs, weaponeering and use of TOW and HELLFIRE against armored threats.

(2) Review TOW and HELLFIRE operations in all modes of delivery and front seat rocket and turret delivery in all modes.

Performance Standards. Conduct the arm/dearm and the Penetration / Depenetration checklist. Conduct simulated missions to engage and destroy point targets and armored threats with a minimum of eight TOW and HELLFIRE engagements IAW the AH-1W NATOPS and TACMAN while exhibiting proper switchology and weaponeering.

Prerequisites. N/A.

Ordnance. N/A.

External Syllabus Support. N/A.

Crew. WTO/PUI.

SWD-241 2.0 C 2 AH-1W A (NS)

Goal. FS - To conduct a live TOW missile shoot and refine TOW/ HELLFIRE proficiency.

Requirement

(1) Discuss ordnance preflight procedures, TOW related emergency procedures, modes of delivery and missile firing reports/data required.

(2) Demonstrate/introduce simulated missions to destroy point targets, including armored threats. Conduct live fire to hit a tank size target while in the TERF environment.

(3) Review TOW and HELLFIRE operations using all modes of delivery, TOW employment, capabilities, limitations, pre- and post-launch constraints, switchology, symbology, terminology and weaponeering.

Performance Standards. During the first attempt, a successful live TOW missile launch after proper missile selection, TOW ready and attack flags achieved, while within engagement envelope.

Prerequisites. TERF-211.

Ordnance. 1 live TOW missile and 1 captive HELLFIRE.

External Syllabus Support. Live fire and LASER safe range.

Crew. WTO (NSI)/PUI.

SWD-242 2.0 C,R 2 AH-1W A (NS)

Goal. FS - To conduct a HELLFIRE shoot and develop TOW/HELLFIRE proficiency.

Requirement

(1) Discuss target acquisition in the night environment, backscatter avoidance techniques, designation employment considerations/techniques, HELLFIRE related emergency procedures and missile firing reports/data required.

(2) Demonstrate/introduce simulated missions to destroy point targets including armored threats while conducting a HELLFIRE shoot to hit a tank size target.

(3) Review TOW/HELLFIRE operations, constraints and employment using all modes of delivery, all sensor systems, LASER, HELLFIRE pre- and post-launch constraints, switchology, weaponeering and J-LASER terminology.

Prerequisites. TERF-211.

Performance Standards. During the first attempt, perform successful missile launch/engagement based on proper missile selection, system bore sight, mode of delivery selection, LASER code entry and within weapons employment envelope.

Ordnance. 1 TOW plug and 1 live/captive HELLFIRE.

External Syllabus Support. Live fire and LASER safe range.

Crew. WTO (NSI)/PUI.

SSWD-243 1.5 C- WST/APT/AH-1W S/A (NS)

Goal. RS - To develop proficiency at ordnance delivery.

Requirement

(1) Discuss weapon switchology with emphasis on ordnance trouble shooting, attack patterns, SOP ordnance procedures, use of rocket charts and delivery techniques, target fixation, ALE-39 components/functions and rocket/gun related emergency procedures.

(2) Demonstrate/introduce 20mm fixed forward and HSS turret fire, rocket delivery using hover, running, pop-up, and diving fire.

(3) Review all ordnance emergencies, CRM during ordnance evolutions and HUD symbology.

Performance Standards. Successful employment of the 20mm weapon system at ranges from 500-1500 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations. Successful employment of 2.75 inch rockets at ranges from 500-2000 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations.

Prerequisites. N/A.

Ordnance. N/A.

External Syllabus Support. Live fire range and LASER safe range if available.

Crew. WTO (NSI)/PUI.

SWD-244 2.0 C 2 AH-1W A NS

Goal. RS - To develop proficiency at ordnance delivery using NVDs.

Requirement

(1) Discuss night ordnance delivery effects, switchology with an emphasis on troubleshooting, use of IR LASER pointers, APR-44 components and operation and CRM regarding target acquisition.

(2) Demonstrate/introduce fixed forward and HSS turret fire, rocket delivery using all modes of delivery and attack patterns with NVDs.

(3) Review all ordnance emergencies, BCWD and error analysis.

Prerequisites. TERF-211.

Performance Standards. Successful employment of the 20mm weapon system at ranges from 500-1500 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations. Successful employment of 2.75 inch rockets at ranges from 500-2000 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations.

Ordnance. 300 rounds 20mm, 7 x 2.75 inch rockets, 4 x 5.00 inch rockets, 1 TOW plug or captive HELLFIRE, 10 chaff, 10 flares and turret mounted IR pointer.

External Syllabus Support. Live fire range and LASER safe range if available.

Crew. NSI/PUI.

SWD-245 2.0 C 2 AH-1W A NS

Goal. OS - Refine ordnance delivery using NVDs.

Requirement

(1) Discuss night ordnance delivery effects, switchology with an emphasis on troubleshooting, use of IR LASER pointers, APR-44 components and operation, and CRM with regard to target acquisition.
(2) Demonstrate/introduce fixed forward and HSS turret fire and rocket delivery using all modes of delivery and attack patterns with NVDs.

(3) Review all ordnance emergencies, BCWD and error analysis.

Prerequisites. SWD-244.

Performance Standards. Successful employment of the 20mm weapon system at ranges from 500-1500 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations. Successful employment of 2.75 inch rockets at ranges from 500-2000 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations.

Ordnance. 300 rounds 20mm, 7 x 2.75 inch rockets, 1 captive HELLFIRE or 1 TOW plug, 10 chaff, 10 flares and turret mounted IR pointer.

External Syllabus Support. Live fire range and LASER safe range if available.

Crew. NSI/PUI.

9. Offensive Air Support (OAS)

a. Purpose. To develop proficiency in OAS under varying threat conditions.

b. General. The PUI will display proficiency in RW CAS in support of a ground unit.

c. Crew Requirements. As listed at the end of each event.

d. Ground/Academic Training. Per the MAWTS-1 Course Catalog.

e. Flight and Simulator Event Training. (2 Sorties, 4.0 Hours/1 Simulator Period, 1.5 Hours).

SOAS-260 1.5 C WST/APT S

Goal. FS - Provide simulated RW CAS to ground forces.

Requirement

(1) Discuss plotting BPs, movement from HAs to BPs, objective area timing, CRM and lookout doctrine.

(2) Demonstrate/introduce a tactical RW SIMCAS mission. Move from a low to medium threat environment during the sortie utilizing CAS mission briefs with and without target marks.

(3) Review all FS ordnance delivery procedures. Conduct a minimum of 5 RW CAS missions utilizing guns, rockets and PGMs in support of a ground force.

Performance Standards. Exhibit a thorough understanding of the CAS mission brief and standard fire support coordination measures used when providing RW CAS.

Prerequisites. N/A.

Ordnance. N/A.

External Syllabus Support. N/A.

Crew. WTO/PUI.

OAS-261 2.0 C 2 AH-1W A

Goal. OS - Provide RW CAS to ground forces.

Requirement

(1) Discuss objective area timing, attack and cover elements, AH-1W weapons integration/synchronization with GCE assets, friendly marking techniques/procedures, identification of friendly/enemy positions and MACCS integration.

(2) Demonstrate/introduce a tactical RW CAS mission utilizing CAS mission briefs, with and without a mark, in a low to medium threat environment.

(3) Review FSC measures, terminal control, BP location, HA to BP movement, CRM principles during RW CAS and terminology. Conduct a minimum of 2 RW CAS missions utilizing CAS mission briefs.

Performance Standards. Exhibit a thorough understanding of the CAS mission brief. Ensure RW ordnance impacts within 30 seconds of the assigned TOT and follow-on ordnance effects are per the TACP directed adjustments.

Prerequisites. TERF-211 and SOAS-260.

Ordnance. 500 rounds 20mm, 7 x 2.75 inch rockets, 1 TOW plug or 1 captive HELLFIRE, 10 chaff, 10 flares.

External Syllabus Support. Live fire range, TACP, LASER safe range (if required).

Crew. WTO/PUI.

OAS-262 2.0 C, R 2 AH-1W A NS

Goal. FS - To provide RW CAS to ground forces at night and qualify the PUI as NSQ (HLL).

Requirement

(1) Discuss night/IR marking methods, employment capabilities of the NTS, sensor management, terminal control procedures at night and CRM during night RW CAS missions.

(2) Demonstrate/introduce a tactical RW CAS mission at night with NVDs utilizing CAS mission briefs, in a low to medium threat environment.

(3) Review J-LASER terminology, IR pointer usage, friendly marking techniques/procedures, identification of friendly/enemy positions and objective area timing. Conduct a minimum of 2 RW CAS missions at night with NVDs utilizing CAS mission briefs.

Performance Standards. Exhibit a thorough understanding of the CAS mission brief. Ensure RW ordnance impacts within 30 seconds of the assigned TOT and ensure ordnance effects are IAW the TACP directed adjustments.

Prerequisites. TERF-211 and SOAS-260.

Ordnance. 500 rounds 20mm, 7 x 2.75 inch rockets, 1 TOW plug or captive HELLFIRE, 10 chaff, 10 flares and turret mounted IR pointer.

External Syllabus Support. Live fire range, TACP, LASER safe range if available.

Crew. NSI/PUI.

APPENDIX G: Core Advanced Phase (300 Level)

Source: Extract from MCO 3500.48A (pages 56-61): T&R syllabus events relevant to weapons employment

SANSQ-313 1.5 C WST/APT S NS

Goal. RS – Introduce ordnance delivery during LLL conditions.

Requirement

(1) Discuss rear seat penetration checklist procedures and techniques. Discuss LLL target acquisition difficulties, LLL ordnance delivery effects, LLL ordnance delivery scan techniques, HUD symbology with respect to target handoff techniques and declutter modes and SOP arming/dearming procedures.

(2) Introduce ordnance delivery utilizing running and diving fire and rear seat ordnance emergencies. Utilize both 5.00 inch and 2.75 inch rockets.

Performance Standards. Conduct arm/dearm procedures and penetration / depenetration checklists IAW TACSOP and local directives. Detect and engage both point and area targets utilizing 20mm (fixed and HSS modes) and rocket (running and pop-up) attacks. Achieve suppressive effects on assigned targets during each engagement. Conduct proper actions in response to inflight ordnance emergencies.

Prerequisites. SANSQ-310.

Ordnance. N/A.

External Syllabus Support. N/A.

Crew. NSI/PUI.

ANSQ-314 2.0 C,R 2 AH-1W A NS

Goal. RS - Review ordnance delivery during LLL conditions.

Requirement

(1) Discuss 20mm ordnance nomenclature and rocket warhead/fuse combinations.

(2) Review ordnance delivery utilizing hover, running, diving fire, SOP arming/dearming procedures, LLL target acquisition difficulties, LLL ordnance delivery effects and scan techniques.

(3) Conduct a tactical mission during which both point and area targets are engaged. Conduct 20mm delivery utilizing fixed and HSS modes and running, pop-up and hover rocket attacks.

Performance Standards. Achieve suppressive effects on assigned targets during each engagement.

Prerequisites. SANSQ-313.

Ordnance. 500 rounds 20mm, 7 x 2.75 inch rockets, 4 x 5.00 inch rockets and turret mounted IR pointer.

External Syllabus Support. Live fire range and LASER safe range if available.

Crew. NSI/PUI.

6. Offensive Air Support (OAS)

a. Purpose. To develop the procedures and skill to tactically employ the aircraft during CAS and AI missions.

b. General. Upon completion of this stage the pilot will be proficient in the planning, briefing and execution aspects of CAS and AI missions. In addition, the pilot will be proficient in the operation and employment of all organic weapon systems. Other OAS missions (AR, SCAR) will be trained to in the Full Combat Qualification phase.

c. Crew Requirements. As listed at the end of each event.

d. Ground/Academic Training. Per the MAWTS-1 Course Catalog.

e. Flight and Simulator Event Training. (5 Sorties, 10.0 Hours).

OAS-320 2.0 C 2 AH-1W A

Goal. FS - Tactically employ the AH-1W in a low to medium threat environment during the conduct of an OAS mission.

Requirement. PUI shall brief the weaponeering portion of the OAS brief (AH-1W with operable VCR).

(1) Discuss ATO and ACEOI utilization and high, medium, and low threat levels.

(2) Introduce JMEMs use as part of mission planning, sensor performance prediction tools (TAWS/EOTDA/TISP) relative to mission planning and cockpit setup with regard to real world complement of mission essential equipment.

(3) Conduct a tactical mission in a low to medium threat environment, wearing body armor.

Performance Standards. Achieve delivery of 2.75 inch rockets or 20mm within 100 meters of target area from a range of 1500m or less during the initial engagement. Using NTS video, validate an effective HELLFIRE engagement of a point target.

Prerequisites. N/A.

Ordnance. 300 rounds 20mm, 7 x 2.75 inch rockets, 2 captive HELLFIRE and 60 flares.

External Syllabus Support. Live fire range and LASER safe range if available.

Crew. WTO/PUI.

OAS-321 2.0 C 2 AH-1W A

Goal. RS - Provide CAS to ground forces.

Requirement. PUI shall brief elevation analysis and Evasive Plan of Action (EPA) in support of the OAS brief (AH-1W with operable VCR).

(1) Introduce integration of FW CAS assets into objective area mechanics. IP shall develop and brief FAC(A) game plan in support of the OAS brief. Introduce elevation analysis and line of sight communication considerations as a part of mission planning. Introduce EPA.

(2) Review integration of attack helicopters into the ground scheme of maneuver and fire support coordination measures.

(3) Conduct CAS in a low to medium threat environment. Utilize PFPS to conduct elevation analysis and line of sight communication considerations.

Performance Standards. PUI shall control FW CAS assets IAW briefed FAC(A) game plan. Achieve the desired effects (as stipulated by the terminal controller) using 5.00 inch rockets or 20mm within 30 seconds of TOT during the initial engagement. Using NTS video, validate an effective PGM engagement of a point target assigned by the terminal controller within 30 seconds of TOT.

Prerequisites. N/A.

Ordnance. 300 rounds 20mm, 4 x 5.00 inch rockets, 1 TOW plug, 1 captive HELLFIRE, 20 chaff and 40 flares.

External Syllabus Support. Live fire range, 1 terminal controller, 2 FW CAS aircraft (may be simulated by IP) and LASER safe range if available.

Crew. WTO/PUI.

OAS-322 2.0 C 3 AH-1W A NS

Goal. RS - Introduce battlefield illumination in support of an OAS mission in a low threat environment.

Requirement. PUI shall brief route portion of OAS brief. PUI shall brief preplanned illumination template (AH-1W with operable EGI, MDL and VCR).

(1) Discuss wind and elevation effects on illumination, other sources of battlefield artificial illumination, use of EGI to enhance accuracy of illumination delivery, illumination types and characteristics (both overt and covert) and use of the Mission Data Loader (MDL).

(2) Introduce illumination delivery profiles.

(3) Conduct illumination rocket delivery.

Performance Standards. Achievement of desired illumination effects (as stipulated in OAS brief) will be debriefed by flight lead. Using NTS video, validate an effective TOW engagement of a point target.

Prerequisites. N/A.

Ordnance. 7 x 2.75 inch illumination rockets, 1 TOW plug, 4 x LUU-2 illumination flares, 20 chaff and 40 flares.

External Syllabus Support. Live fire range and LASER safe range if available.

Crew. NSI/PUI.

OAS-323 2.0 C,R 2 AH-1W A NS

Goal. RS - Provide CAS to ground forces at night.

Requirement. PUI shall brief objective area portion of OAS brief (AH-1W equipped with operable VCR).

(1) Discuss MACCS agencies and integration, J-LASER terminology, IR pointer usage and friendly position marking techniques and procedures.

(2) Introduce integration of indirect fire assets into objective area mechanics.

(3) Conduct night CAS in a low to medium threat environment. PUI shall control indirect fire assets in support of terminal controller's objectives.

Performance Standards. Achieve the desired effects (as stipulated by the terminal controller) using 2.75 inch rockets or 20mm within 15 seconds of TOT during the initial engagement. Validate, using NTS video, an effective PGM engagement of a point target assigned by the terminal controller within 15 seconds of TOT.

Prerequisites. N/A.

Ordnance. 300 rounds 20mm, 7 x 2.75 inch rockets, 1 TOW plug or 1 captive HELLFIRE, 20 chaff, 40 flares and turret mounted IR pointer.

External Syllabus Support. Live fire range, LASER safe range, 1 terminal controller with LASER designator and 1 indirect fire asset (may be simulated by IP).

Crew. NSI/PUI.

OAS-324 2.0 C,R 2 AH-1W A NS

Goal. FS - Conduct a preplanned AI mission at night.

Requirement. PUI will conduct OAS brief. AH-1W equipped with operable EGI and VCR.

(1) Discuss PFPS radar terrain masking (RTM) options, BDA requirements and techniques, FARP operations and fuel planning.

(2) Review pre-mission planning with emphasis on threat analysis, JMEMs and weapon to target match. OAS brief shall include a FARP brief. Prepare a PFPS Radar Terrain Mask analysis of threat systems. Plan and execute a preplanned AI mission in a medium to high threat environment.

(3) Conduct FARP operation utilizing MWSS, CH-53 TBFDS or KC-130 RGR if available.

Performance Standards. Per AH-1W TACMAN.

Prerequisites. N/A.

Ordnance. 300 rounds 20mm, 3 x 2.75 inch rockets, 1 TOW plug, 1 live or captive HELLFIRE, 40 chaff and 20 flares.

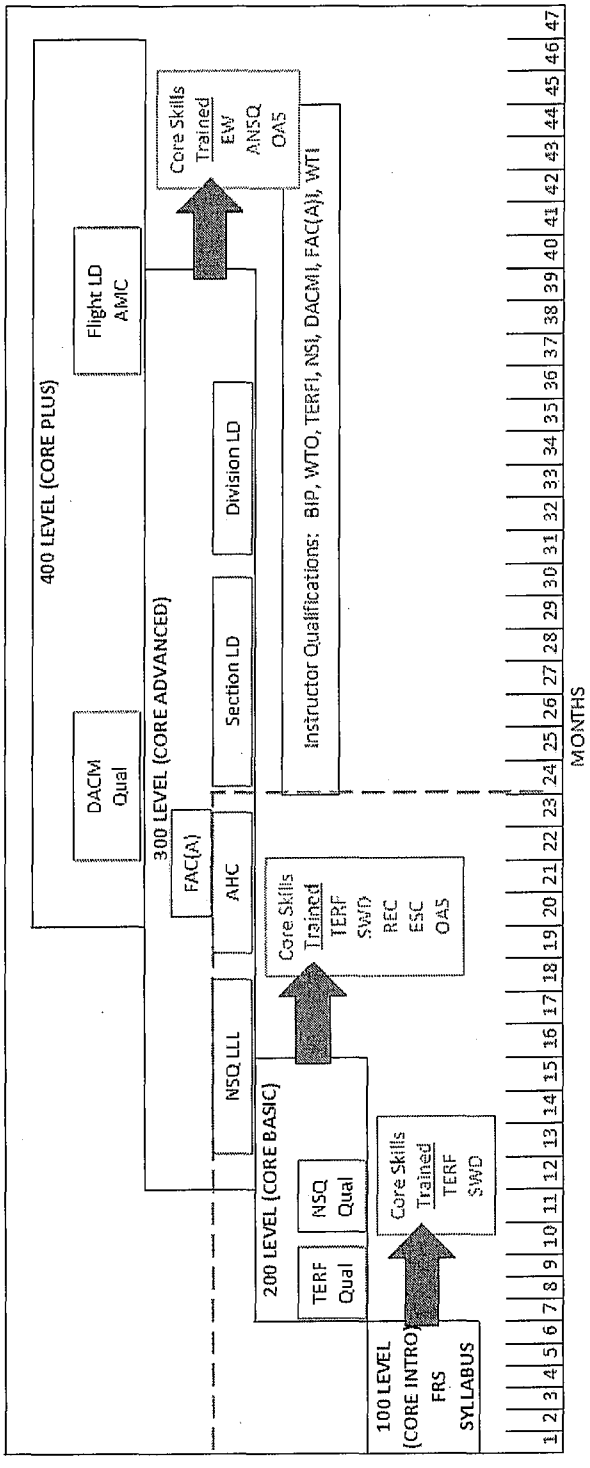
External Syllabus Support. Live fire range, LASER safe range, 1 TRTG or remote radar emitter and 1 FARP asset if available.

Crew. NSI/PUI.

APPENDIX H: Core Skill Progression Model

Source: MCO 3500.48A Aviation Training and Readiness (T&R) Manual, AH-1 (page 10)

The chart below depicts Core Skill development required by Phase of pilot progression.



APPENDIX I: Relevant Core Skill T&R Events by Phase

Source: MCO 3500.48A Aviation Training and Readiness (T&R) Manual, AH-1 (para. 131-133)

Table 1: Core Introduction Phase

EVENT			HOURS	ORDNANCE		
				20mm	2.75"	5.00"
SSWD-160	Goal	Introduce Cobra weapon systems	1.5			
	Aircraft / Simulator	Simulator				
	Seat	FS				
	Performance Standard	Per AH-1W NATOPS, TACMAN, and MDG				
SWD-161	Goal	Introduce SWD gunnery	2.0	400		
	Aircraft / Simulator	Aircraft				
	Seat	FS				
	Performance Standard	Per AH-1W NATOPS, TACMAN, and MDG				
SSWD-162	Goal	Introduce weapon systems	1.5	400		
	Aircraft / Simulator	Simulator				
	Seat	RS				
	Performance Standard	Per AH-1W NATOPS, TACMAN, and MDG				
SWD-163	Goal	Review SWD gunnery	2.0	400	7	4
	Aircraft / Simulator	Aircraft				
	Seat	RS				
	Performance Standard	Per AH-1W NATOPS, TACMAN, and MDG				
SWD-164	Goal	Weapon systems evaluation	2.0	200	12	
	Aircraft / Simulator	Aircraft				
	Seat	RS				
	Performance Standard	Per AH-1W NATOPS, TACMAN, and MDG				
SWD-165	Goal	Weapons review	1.5			
	Aircraft / Simulator	Simulator				
	Seat	FS				
	Performance Standard	Per AH-1W NATOPS, TACMAN, and MDG				

	HOURS	ORDNANCE		
		20mm	2.75"	5.00"
TOTAL	10.5	1400	19	4

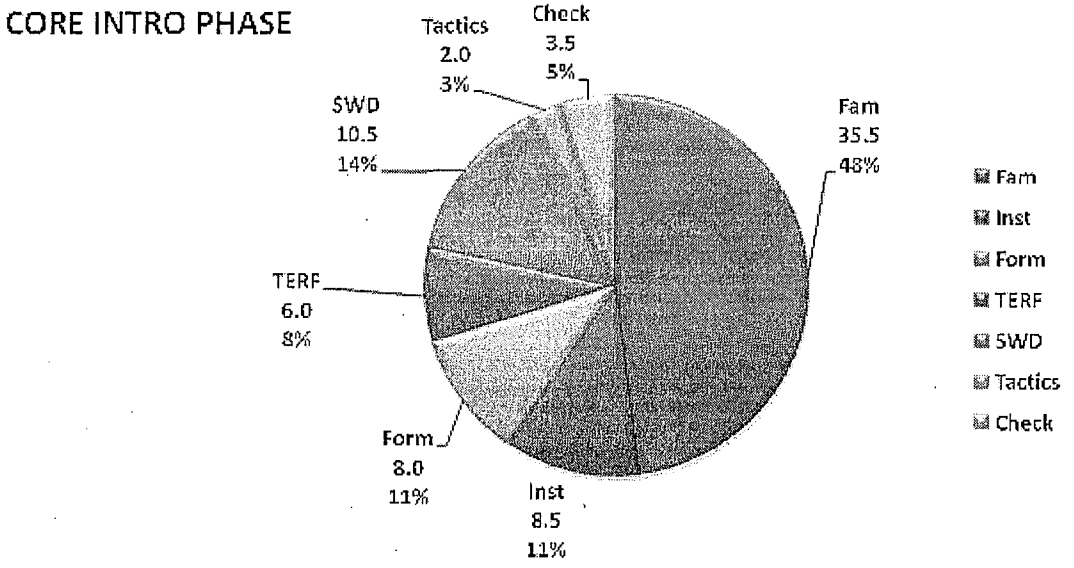


Table 2: Core Basic Phase

EVENT			HOURS	ORDNANCE			
				20mm	2.75"	5.00"	PGM
SSWD-240	Goal	To develop proficiency using TOW and HELLFIRE missile systems	1.5				
	Aircraft / Simulator	Simulator					
	Seat	FS					
	Performance Standard	Conduct the arm/dearm and the Penetration / Depentration checklist. Conduct simulated missions to engage and destroy point targets and armored threats with a minimum of eight TOW and HELLFIRE engagements IAW the AH-1W NATOPS and TACMAN while exhibiting proper switchology and weaponeering.					
SWD-241	Goal	To conduct a live TOW missile shoot and refine TOW / HELLFIRE proficiency.	2.0				Live TOW / Captive HELLFIRE
	Aircraft / Simulator	Aircraft					
	Seat	FS					
	Performance Standard	During the first attempt, a successful live TOW missile launch after proper misile selection, TOW ready and attack flags achieved, while within engagement					
SWD-242	Goal	To conduct a HELLFIRE shoot and develop TOW / HELLFIRE proficiency.	2.0				Live HELLFIRE / Captive TOW
	Aircraft / Simulator	Aircraft					
	Seat	FS					
	Performance Standard	During the first attempt, perform successful missile launch / engagement based on proper missile selection, system bore sight, mode of delivery selection, LASER code entry and within weapons engagement					
SSWD-243	Goal	To develop proficiency at ordnance delivery.	1.5				
	Aircraft / Simulator	Simulator					
	Seat	RS					
	Performance Standard	Successful employment of the 20mm weapon system at ranges from 500-1500 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations. Successful employment of 2.75 inch rockets at ranges from 500-2000 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations.					

EVENT			HOURS	ORDNANCE			
				20mm	2.75"	5.00"	PGM
SWD-244	Goal	To develop proficiency at ordnance delivery using NVDs.	2.0	300	7	4	Captive PGM
	Aircraft / Simulator	Aircraft					
	Seat	RS					
	Performance Standard	Successful employment of the 20mm weapon system at ranges from 500-1500 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations. Successful employment of 2.75 inch rockets at ranges from 500-2000 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations.					
SWD-245	Goal	Refine ordnance delivery using NVDs.	2.0	300	7		Captive PGM
	Aircraft / Simulator	Aircraft					
	Seat	OS					
	Performance Standard	Successful employment of the 20mm weapon system at ranges from 500-1500 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations. Successful employment of 2.75 inch rockets at ranges from 500-2000 meters, exhibiting proper impact detection and adjustment, to work towards effect on target while adhering to all range regulations.					
SOAS-260	Goal	Provide simulated RW CAS to ground forces	1.5				
	Aircraft / Simulator	Simulator					
	Seat	FS					
	Performance Standard	Exhibit a thorough understanding of the CAS mission brief and standard fire support coordination measures used when providing RW CAS.					
OAS-261	Goal	Provide RW CAS to ground forces	2.0	500	7		Captive TOW / HELLFIRE
	Aircraft / Simulator	Aircraft					
	Seat	OS					
	Performance Standard	Exhibit a thorough understanding of the CAS mission brief. Ensure RW ordnance impacts within 30 seconds of the assigned TOT and follow-on ordnance effects are per TACP directed adjustments.					

EVENT			HOURS	ORDNANCE			
				20mm	2.75"	5.00"	PGM
OAS-262	Goal	To provide RW CAS to ground forces at night and qualify the PUI as NSQ (HLL)	2.0	500	7		Captive TOW / HELLFIRE
	Aircraft / Simulator	Aircraft					
	Seat	FS					
	Performance Standard	Exhibit a thorough understanding of the CAS mission brief. Ensure RW ordnance impacts within 30 seconds of the assigned TOT and ensure ordnance effects are IAW the TACP directed adjustments.					

	HOURS	ORDNANCE			
		20mm	2.75"	5.00"	PGM
TOTAL	11.0	1600	28		2

CORE BASIC PHASE

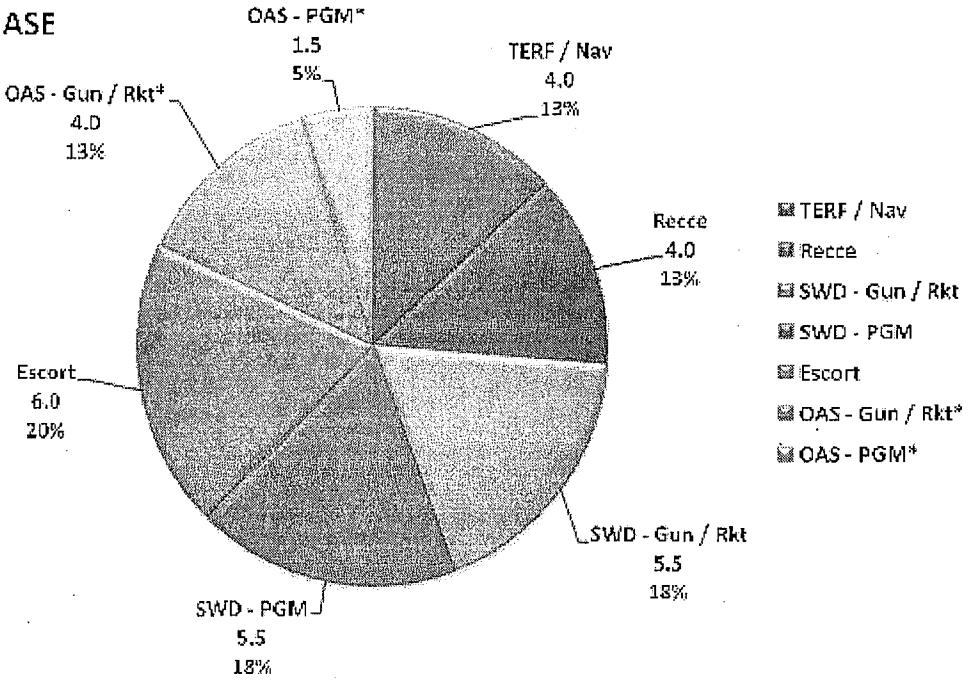


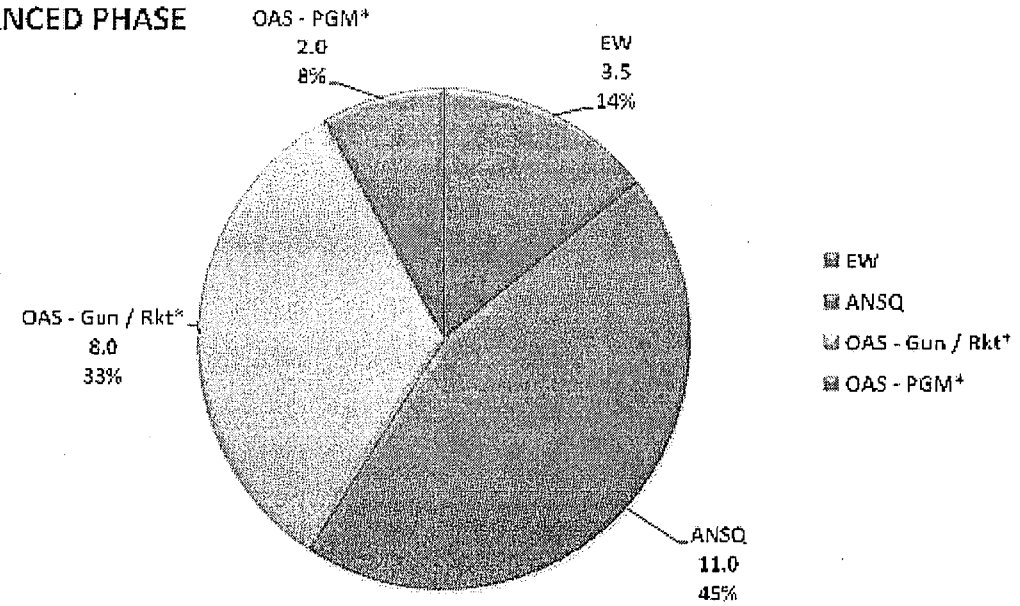
Table 3: Core Advanced Phase

EVENT			HOURS	ORDNANCE			
				20mm	2.75"	5.00"	PGM
SANSQ-313	Goal	Introduce ordnance delivery during LLL conditions	1.5				
	Aircraft / Simulator	Simulator					
	Seat	RS					
	Performance Standard	penetration / depenetration checklists IAW TACSOP and local directives. Detect and engage both point and area targets utilizing 20mm (fixed and HSS modes) and rocket (running and pop-up) attacks. Achieve suppressive effects on assigned targets during each engagement. Conduct proper actions in response to inflight ordnance emergencies.					
ANSQ-314	Goal	Review ordnance delivery during LLL conditions	2.0	300	7	4	
	Aircraft / Simulator	Aircraft					
	Seat	RS					
	Performance Standard	Achieve suppressive effects on asigned targets during each engagement.					
OAS-320	Goal	Tactically employ the AH-1W in a low to medium threat environment during the conduct of an OAS mission	2.0	300	7		Captive HELLFIRE
	Aircraft / Simulator	Aircraft					
	Seat	FS					
	Performance Standard	Achieve delivery of 2.75 inch rockets or 20mm within 100 meters of target are from a range of 1500m or less during the intial engagement. Using NTS video, validate an effective HELLFIRE engagement of a point target.					
OAS-321	Goal	Provide CAS to ground forces	2.0	300		4	Captive Tow / HELLFIRE
	Aircraft / Simulator	Aircraft					
	Seat	RS					
	Performance Standard	PUI shall control FW CAS assets IAW briefed FAC(A) game plan. Achieve the desired effects (as stipulated by the terminal controller) using 5.00 inch rockets or 20mm within 30 seconds of TOT during the initial engagement. Using NTS video, validate an effective PGM engagement of a point target assigned by the terminal controller within 30 seconds of TOT.					

EVENT			HOURS	ORDNANCE			
				20mm	2.75"	5.00"	PGM
OAS-322	Goal	Introduce battlefield illumination in support of an OAS mission in a low threat environment	2.0		7 Illim / 4 LUU-2		Captive TOW
	Aircraft / Simulator	Aircraft					
	Seat	RS					
	Performance Standard	Achievement of desired illumination effects (as stipulated in an OAS brief) will be debriefed by flight lead. Using NTS video, validate an effective TOW engagement of a point target.					
OAS-323	Goal	Provide CAS to ground forces at night	2.0	300	7		Captive TOW / HELLFIRE
	Aircraft / Simulator	Aircraft					
	Seat	RS					
	Performance Standard	Achieve desired effects (as stipulated by the terminal controller) using 2.75 inch rockets or 20mm within 15 seconds of TOT during initial engagement. Validate, using NTS video, an effective PGM engagement of a point target assigned by the terminal controller within 15 seconds of TOT.					
OAS-324	Goal	night	2.0	300	3		Captive TOW / HELLFIRE
	Aircraft / Simulator	Aircraft					
	Seat	FS					
	Performance Standard	Per AH-1W TACMAN					

	HOURS	ORDNANCE			
		20mm	2.75"	5.00"	PGM
TOTAL	13.5	1700	24	8	Captives

CORE ADVANCED PHASE



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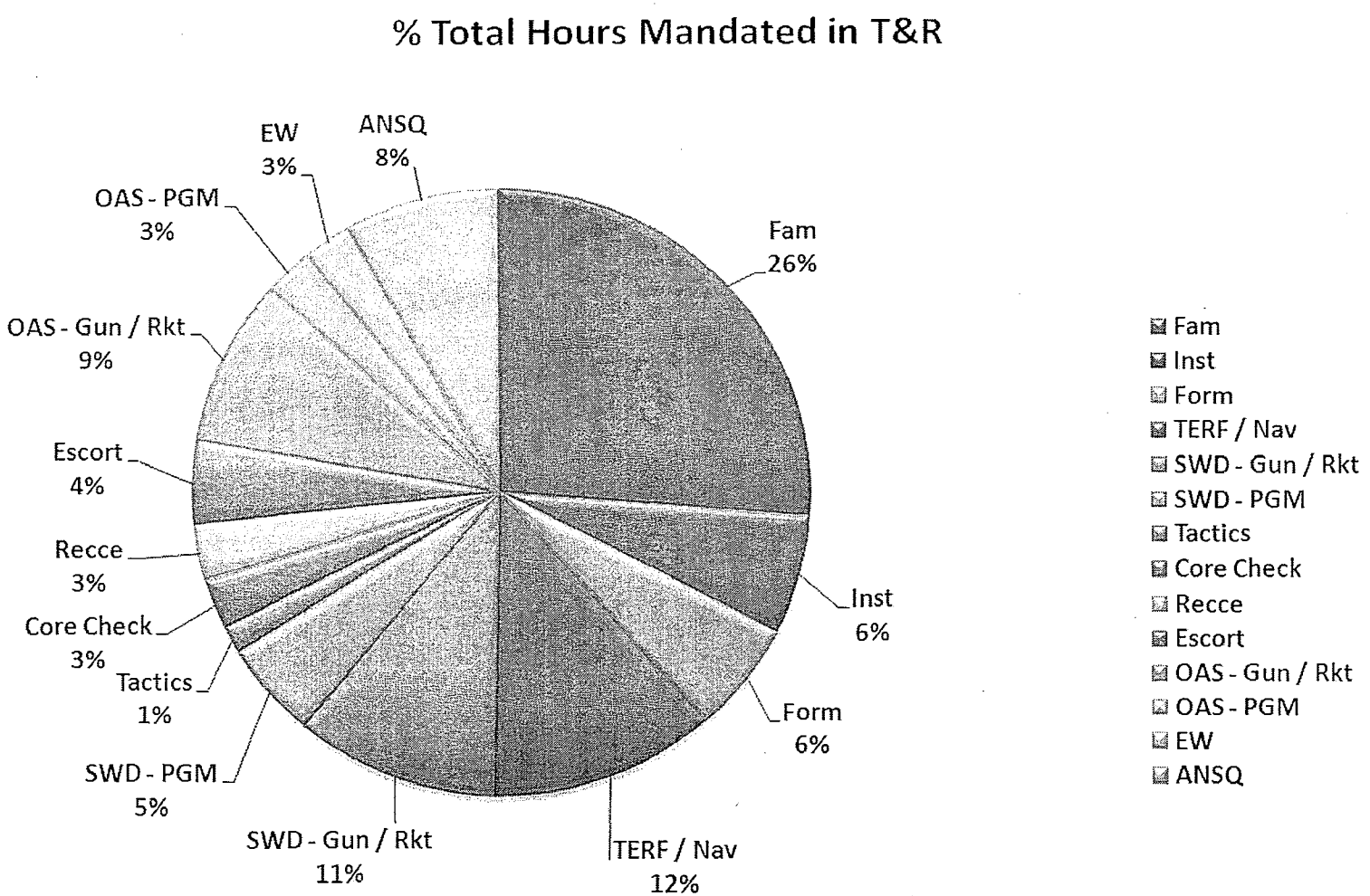
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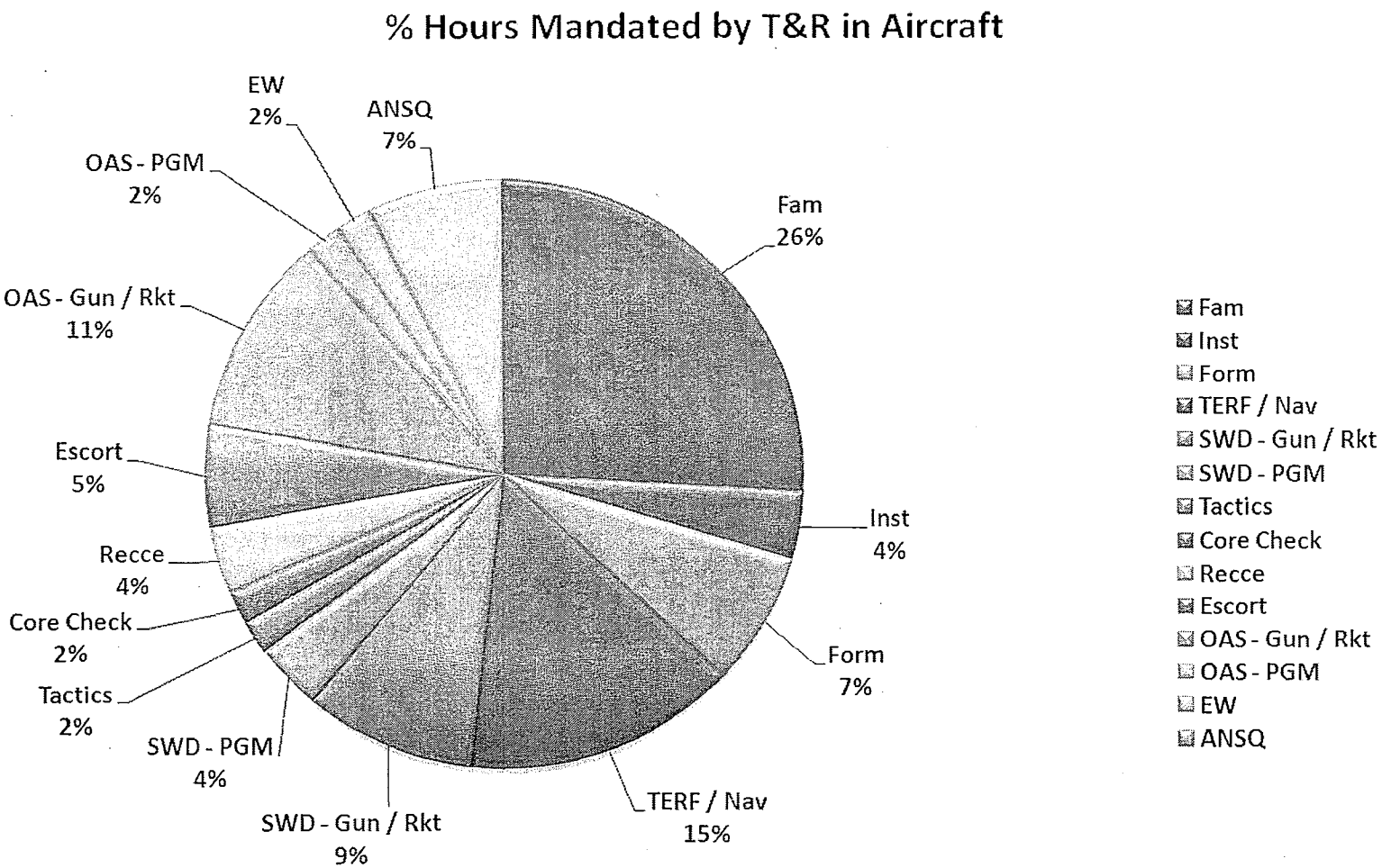
Fam 26%
Inst 6%
Form 6%
TERF / Nav 12%
SWD - Gun / Rkt 11%
SWD - PGM 5%
Tactics 1%
Core Check 3%
Recce 3%
Escort 4%
OAS - Gun / Rkt 9%
OAS - PGM 3%
EW 3%
ANSQ 8%
Fam
Inst
Form
TERF / Nav
SWD - Gun / Rkt
SWD - PGM
Tactics
Core Check
Recce
Escort
OAS - Gun / Rkt
OAS - PGM
EW
ANSQ

Chart 2: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EW 2%
ANSQ 7%
OAS - PGM 2%
Fam 26%
OAS - Gun / Rkt 11%
Escort 5%
Inst 4%
Recce 4%
Core Check 2%
Form 7%
Tactics 2%
SWD - PGM 4%
TERF / Nav 15%
SWD - Gun / Rkt 9%
Fam
Inst
Form
TERF / Nav
SWD - Gun / Rkt
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Tactics
Core Check
Recce
Escort
OAS - Gun / Rkt
OAS - PGM
EW
ANSQ

Chart 3:

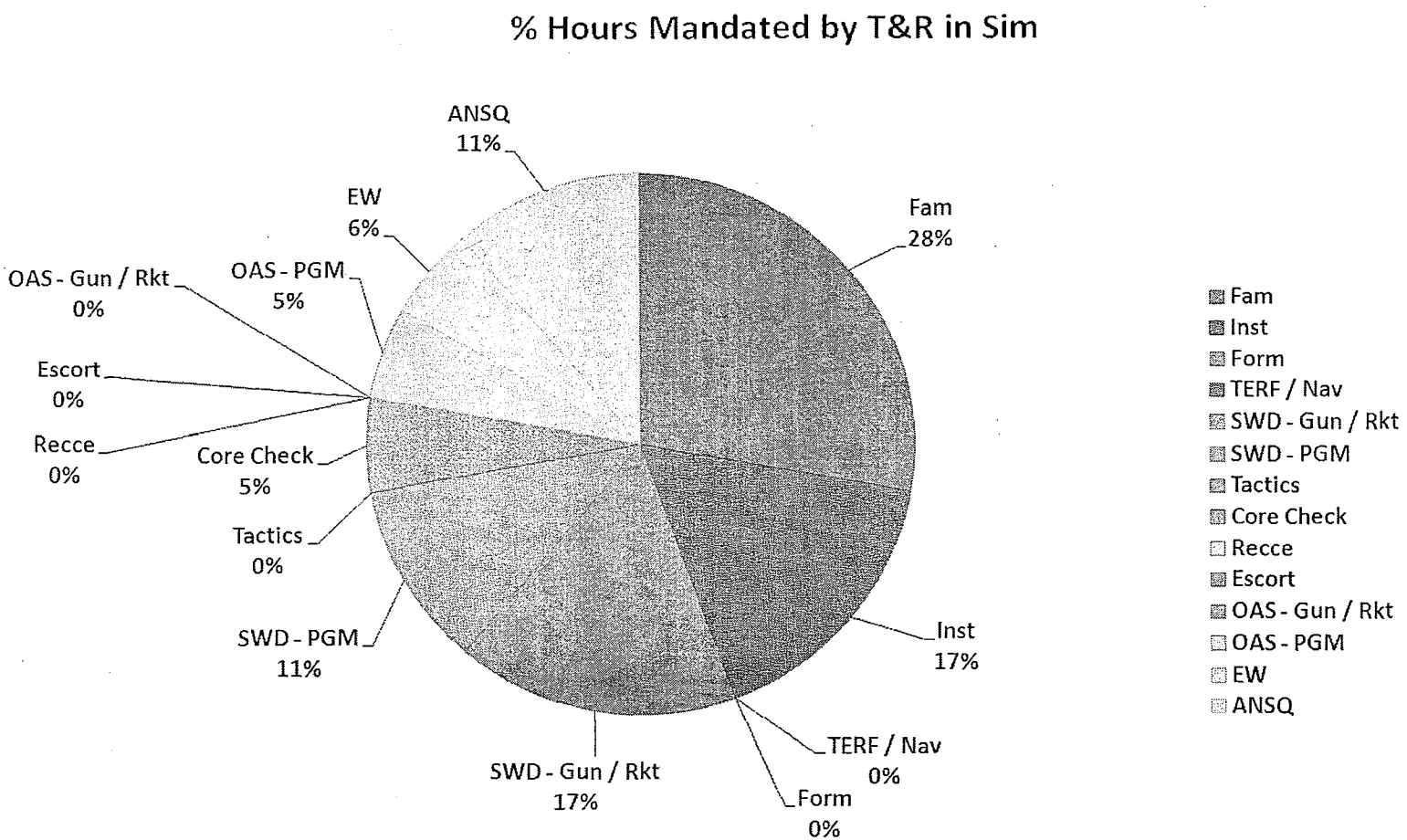

% Hours Mandated by T&R in Sim
ANSQ 11%
EW 6%
OAS - PGM 5%
OAS - Gun / Rkt 0%
Escort 0%
Recce 0%
Core Check 5%
Tactics 0%
SWD - PGM 11%
SWD - Gun / Rkt 17%
Form 0%
TERF / Nav 0%
Inst 17%
Fam 28%
Fam
Inst
Form
TERF / Nav
SWD - Gun / Rkt
SWD - PGM
Tactics
Core Check
Recce
Escort
OAS - Gun / Rkt
OAS - PGM
EW
ANSQ

Table 4:

AH-1W Weapons Employment Training

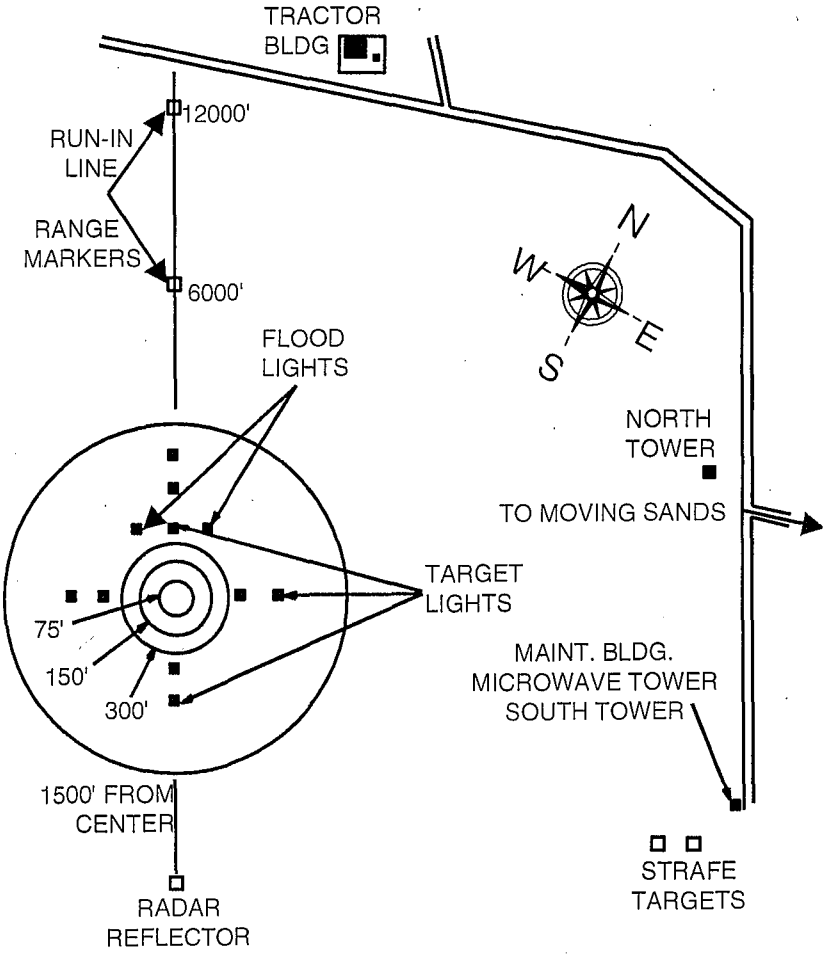
Level	Event	Hours	20mm	Rockets	PGM
100: Core Intro	SSWD-160	1.5			
	SWD-161	2.0	400		
	SSWD-162	1.5	400		
	SWD-163	2.0	400	11	
	SWD-164	2.0	200	12	
	SSWD-165	1.5			
200: Core Basic	SSWD-240	1.5			
	SWD-241	2.0			1 TOW
	SWD-242	2.0			1 HF
	SSWD-243	1.5			
	SWD-244	2.0	300	11	
	SWD-245	2.0	300	7	Captive
	SOAS-260*	1.5			
	OAS-261*	2.0	500	7	Captive
	OAS-262*	2.0	500	7	Captive
300: Core Advanced	SANSQ-313	1.5			
	ANSQ-314	2.0	500	11	
	OAS-320*	2.0	300	7	Captive
	OAS-321*	2.0	300	4	Captive
	OAS-322*	2.0		7 Illum	Captive
	OAS-323*	2.0	300	7	Captive
	OAS-324*	2.0	300	3	Captive
	Totals	40.5	4700	94	2

NOTE: Right justified = Simulator Event
Left justified = OAS or PGM oriented Event
Center justified = SWD Rocket / Gun Event

APPENDIX J: Cactus West Range Complex (R-2301W)

Source: MCAS Yuma Range Management, *Cactus West (R-2301W)*, <http://www.yuma.usmc.mil/services/range/ranges/cactuswe.htm> (12 December 2007).

R-2301W Cactus West

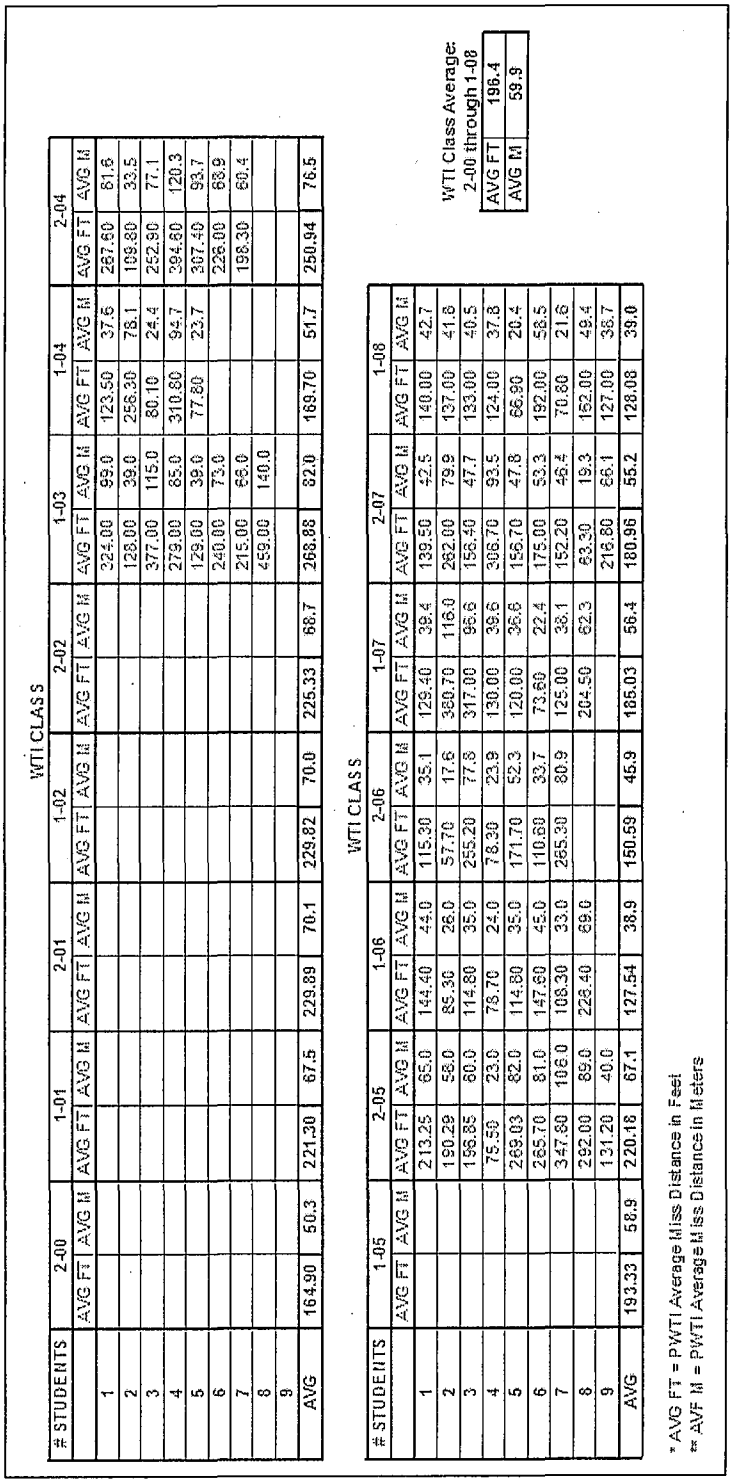


ELEVATION: 397'
LAT./LONG.: N32°27'34.2" W114°24'08.4"
GRID: WGS-84 11S QR 442 943
"PIGEONS": NYL 124°/15.5
FREQUENCIES: 245.0 (YUMA RANGE CNTL)
358.6 PRI
262.6 SEC

APPENDIX K: MAWTS-1 Rocket Data Analysis

Source: MAWTS-1 Cobra Division, WTI Class Rocket Derby Results, Classes 2-00 through 1-08, 2000-2008; data maintained at MAWTS-1, MCAS Yuma, AZ.

Table 1: Class Summary



WTI CLASS

# STUDENTS	2-00		1-01		2-01		1-02		2-02		1-03		1-04		2-04	
	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M
1											224.00	99.0	123.50	37.6	267.60	81.6
2											128.00	39.0	256.30	78.1	109.80	33.5
3											377.00	115.0	80.10	24.4	252.90	77.1
4											279.00	85.0	310.80	94.7	394.60	120.3
5											129.00	39.0	77.80	23.7	367.40	93.7
6											240.00	73.0			226.00	68.9
7											215.00	66.0			198.30	60.4
8											459.00	140.0				
9																
AVG	164.90	50.3	221.30	67.5	229.89	70.1	229.82	70.0	225.33	68.7	268.88	82.0	169.70	51.7	250.94	76.5

WTI CLASS

# STUDENTS	1-05		2-05		1-06		2-06		1-07		2-07		1-08	
	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M	AVG FT	AVG M
1			213.25	65.0	144.40	44.0	115.30	35.1	129.40	39.4	139.50	42.5	140.00	42.7
2			190.29	58.0	85.30	26.0	57.70	17.6	380.70	116.0	262.00	79.9	137.00	41.8
3			196.85	60.0	114.80	35.0	255.20	77.8	317.00	96.6	156.40	47.7	133.00	40.5
4			75.50	23.0	78.70	24.0	78.30	23.9	130.00	39.6	306.70	93.5	124.00	37.8
5			269.03	82.0	114.80	35.0	171.70	52.3	120.00	36.6	156.70	47.8	66.90	20.4
6			265.70	81.0	147.60	45.0	110.60	33.7	73.60	22.4	175.00	53.3	192.00	58.5
7			347.80	106.0	108.30	33.0	265.30	80.9	125.00	38.1	152.20	46.4	70.80	21.6
8			292.00	89.0	228.40	69.6			204.50	62.3	63.30	19.3	162.00	49.4
9			131.20	40.0							216.80	66.1	127.00	38.7
AVG	193.33	58.9	220.16	67.1	127.54	38.9	150.59	45.9	185.03	56.4	180.96	55.2	128.08	39.0

WTI Class Average:
2-00 through 1-08

AVG FT	196.4
AVG M	59.9

* AVG FT = PWTI Average Miss Distance in Feet
** AVF M = PWTI Average Miss Distance in Meters

Chart 1: MAWTS-1 "Rocket Derby": High Student, Low Student, Class Average

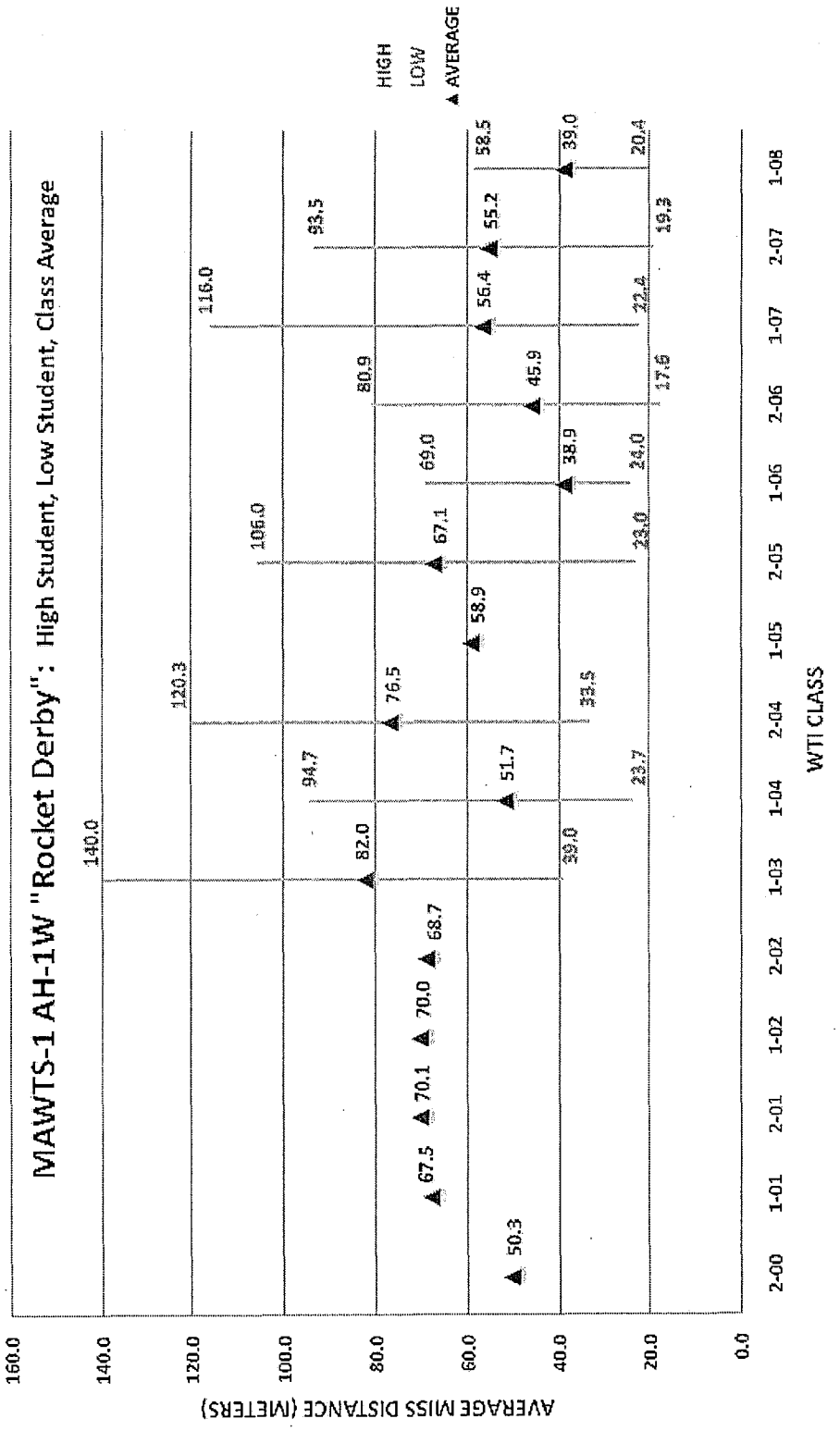


Chart 2: MAWTS-1 AH-1W "Rocket Derby" Logarithmic Trend Analysis

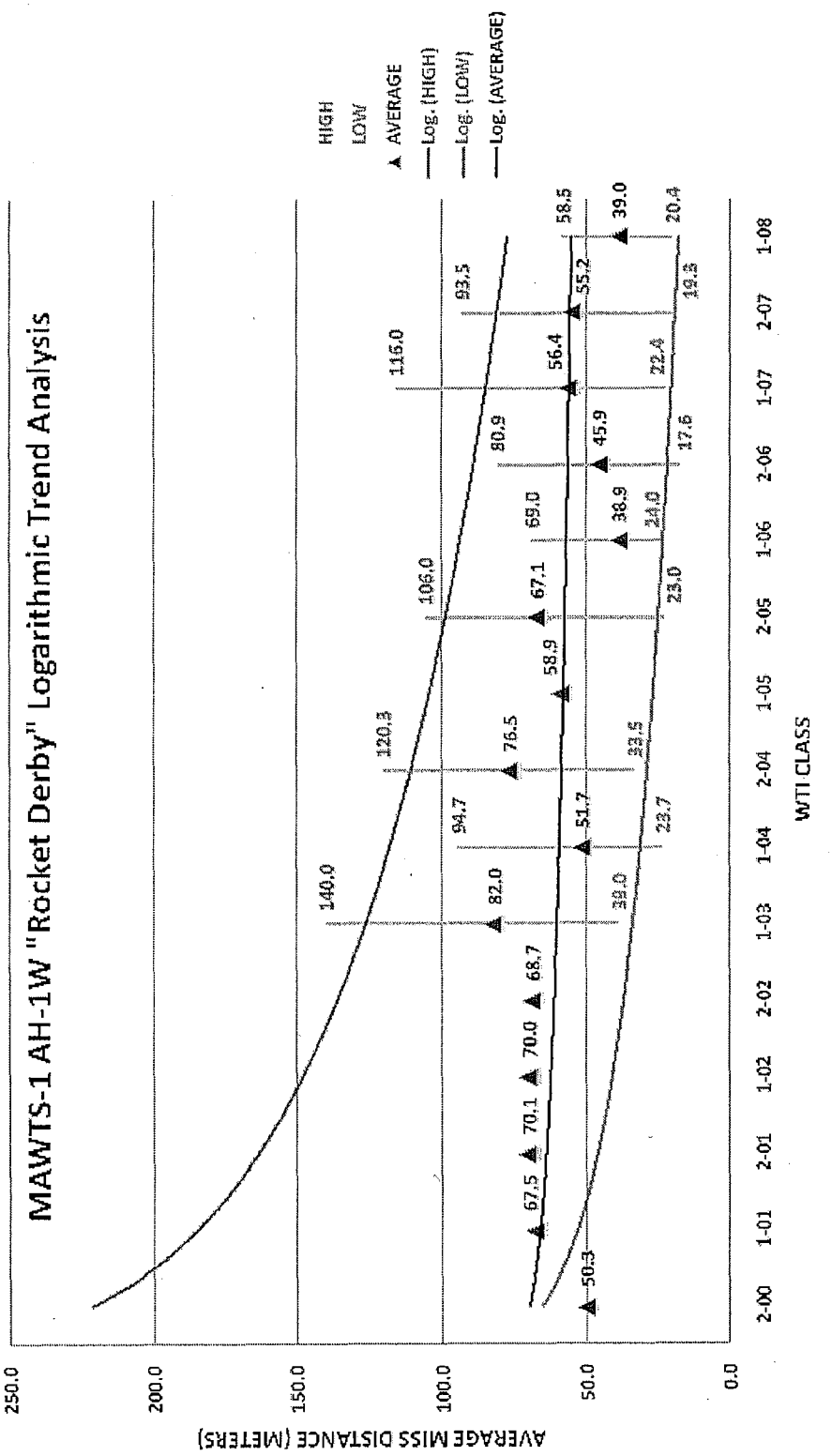


Chart 3: MAWTS-1 AH-1W "Rocket Derby" 5 Class Trend Analysis #1

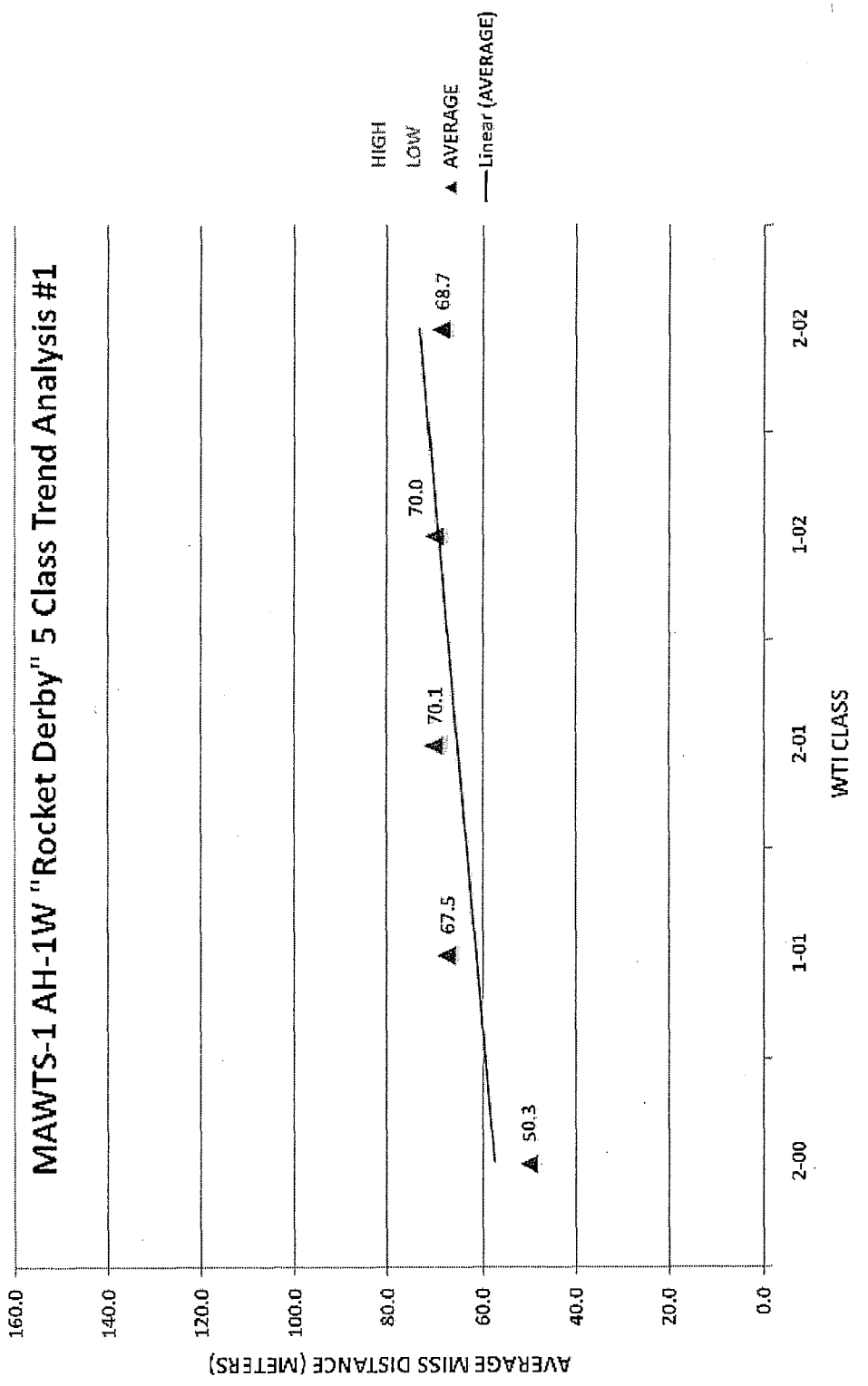


Chart 4: MAWTS-1 AH-1W "Rocket Derby" 5 Class Trend Analysis #2

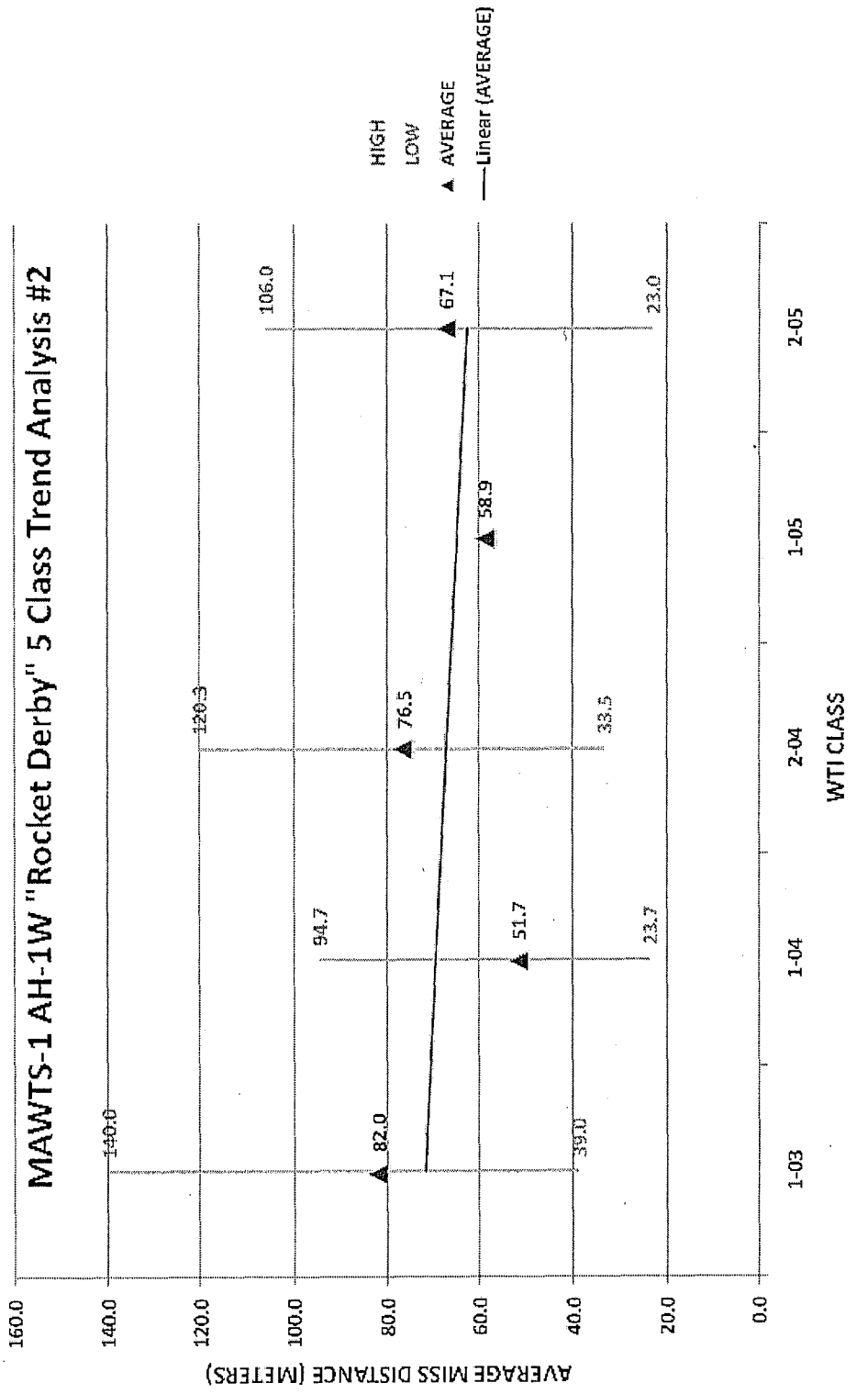


Chart 5: MAWTS-1 AH-1W "Rocket Derby" 5 Class Trend Analysis #3

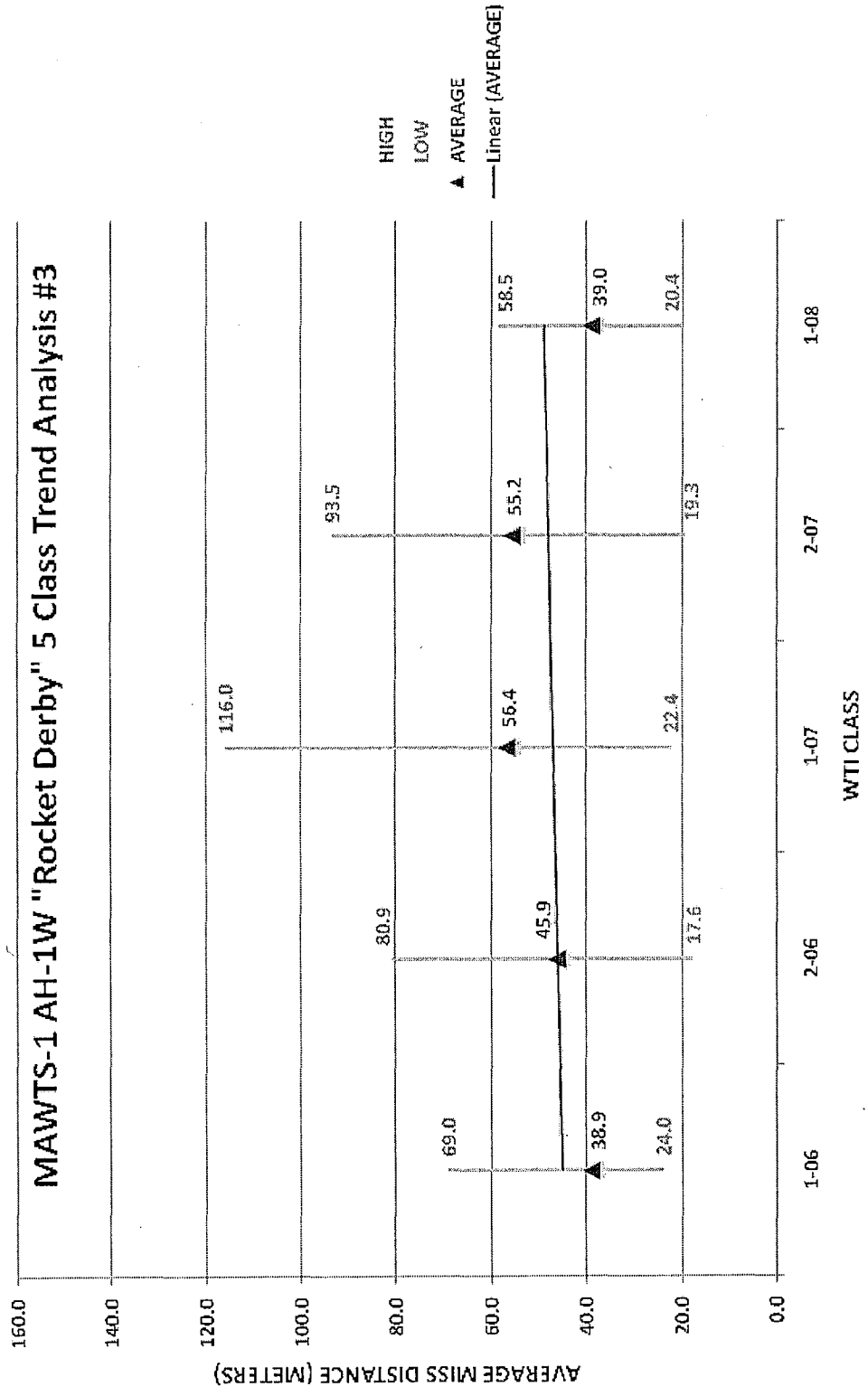
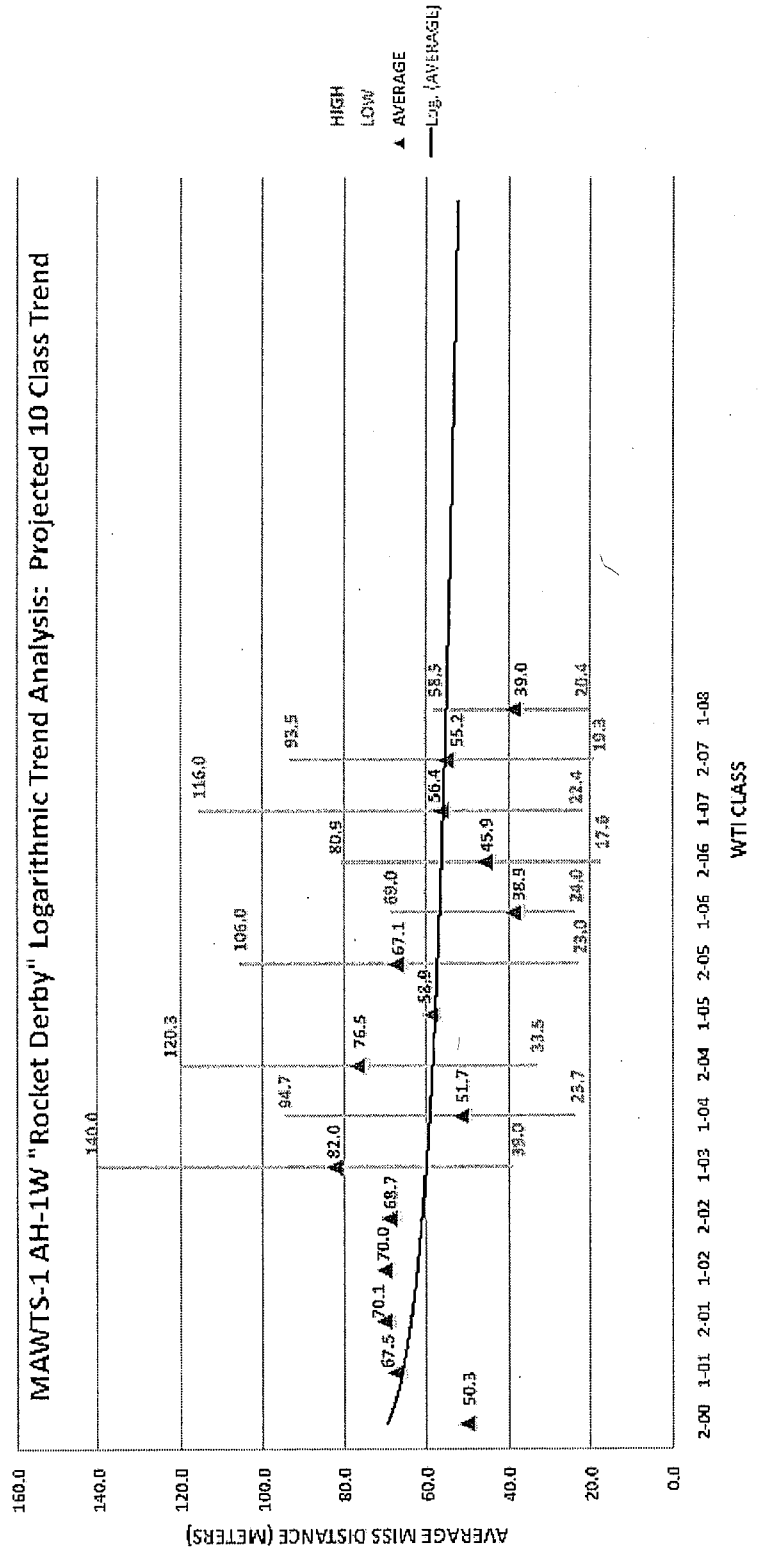


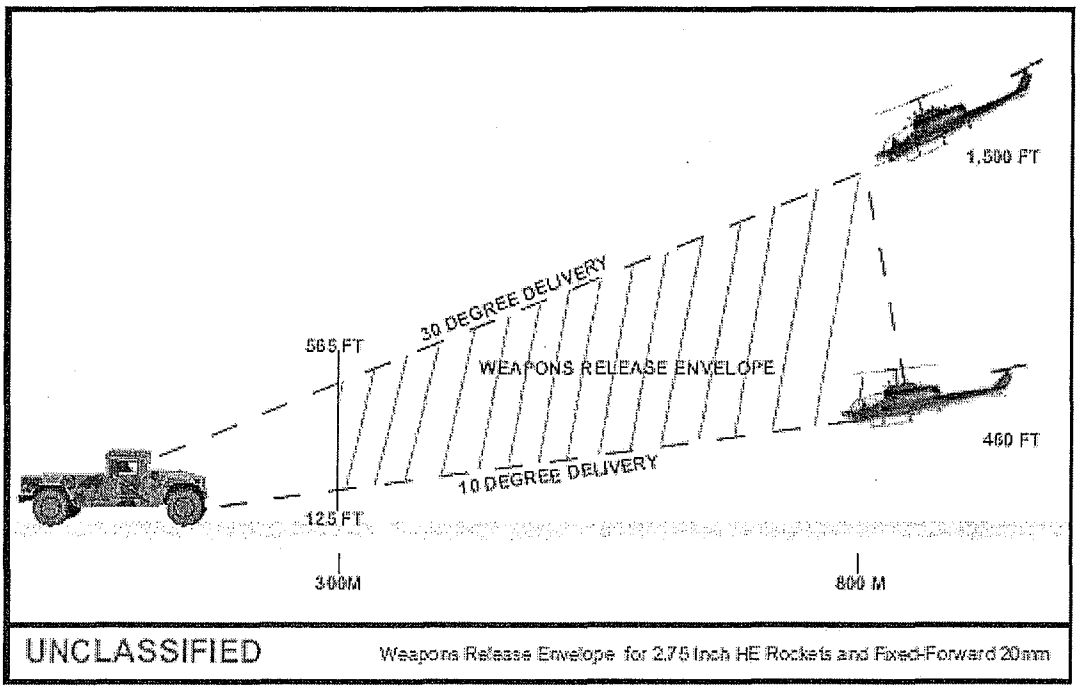
Chart 6: MAWTS-1 AH-1W "Rocket Derby" Logarithmic Trend Analysis: Projected 10 Class Trend



APPENDIX L: Weapons Release Envelope

Source: *Air NTTP 3-22.3-AH-1W, Combat Aircraft Fundamentals - AH-1W (U)*July 2007, 3-34.

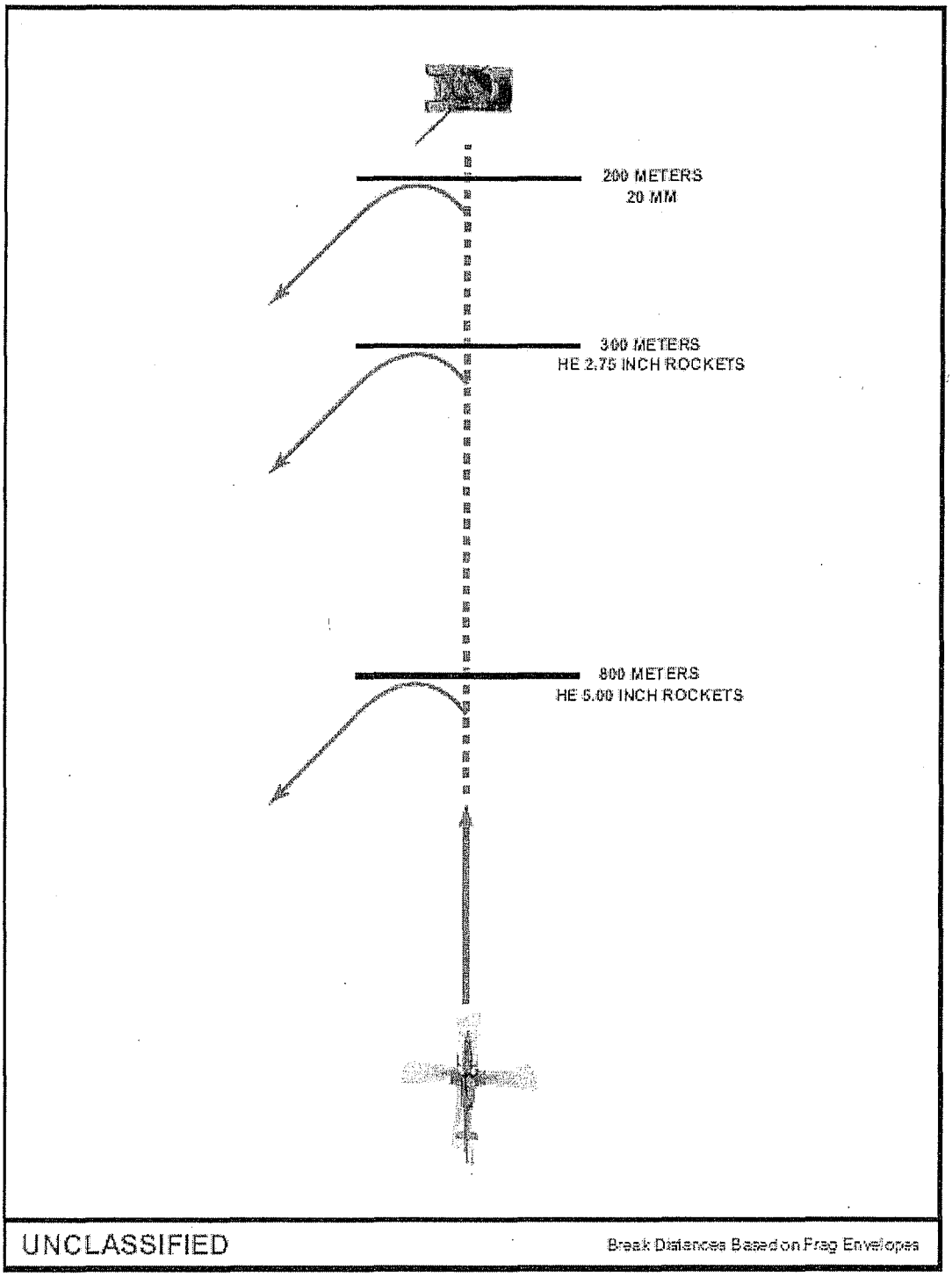
Figure 1: Weapons Release Envelope for 2.75" High Explosive Rockets and Fixed-Forward 20mm



Release Envelope Entry. The entry into the release envelope is inconsequential. In other words, it may be a straight-path 20-degree dive from 1,500 meters, or an NOE (Nap of Earth) pop at 600 meters into a brief 30-degree dive. Recognize that within the envelope, the most inaccurate delivery will come from the 800-meter 10-degree corner, and the most accurate delivery from the 300-meter 30-degree corner. As with everything, specific release parameters will be driven by METT-T considerations.

Source: *Air NTTP 3-22.3-AH-1W, Combat Aircraft Fundamentals - AH-1W (U)*July 2007, 3-17.

Figure 2: Break Distances Based on Frag Envelopes



APPENDIX M: Interview Questionnaire Cover Letter

From: Major Richard D. Joyce, CSC Student, CG #12
TO:

Subj: INTERVIEW QUESTIONNAIRE: UNGUIDED WEAPONS EMPLOYMENT AND THE T&R

Encl: (1) Interview Questionnaire

1. As per our conversation, attached is a short interview questionnaire in reference to unguided weapons employment in the AH-1W community. The purpose of this questionnaire is simply to gather data from community experts as I continue research in pursuit of a Masters of Military Studies from Marine Corps Command and Staff College. My research focuses on exploring two basic questions:

a. Is the current AH-1W T&R Syllabus properly designed to produce competent and effective attack pilots with the requisite unguided weapons employment skills required in current and future conflict?
b. By what measure are those skills evaluated in order to ensure minimum standards are achieved throughout the community?

These two questions raise numerous additional considerations related to the topic, but provide a starting point as I move forward.

2. The questionnaire is designed to solicit your opinion regarding a few specific issues surrounding unguided weapons employment training and skill. It is not intended to present leading questions that constrain your answers or limit your responses. I will ensure any follow-up phone conversations or correspondence are consolidated and resubmitted to you for review prior to inclusion in the final paper.

3. I realize that everyone is extremely busy these days and appreciate your effort in assisting me. All I can offer for your assistance is a copy of the final paper should you desire to see the end result. If you have any questions, please contact me by any of the following means:

a. Home: (540)659-XXXX
b. Cell: (931)206-XXXX
c. NIPR: richard.d.joyce@usmc.mil
d. Email: dick.joyce@xxxxx.com

R.D. JOYCE
Major, U.S. Marine Corps

APPENDIX N: Interview Questionnaire – Unguided Weapons Employment and the T&R

1. What is the most important tactical skill set an aspiring Attack Helicopter Commander should train for? (i.e. navigation, radio communications, flight planning, weapons employment, etc.)

2. Do you believe that unguided weapons employment skills are still viable in light of the advances made in precision guided munitions and the future procurement of weapons systems such as the laser guided rocket?

3. Does the current AH-1W T&R contain established Standards that are effective, reasonable, and adhered to in order to evaluate individual pilot unguided weapons employment skill? If not, do you have any suggestions based on your experience?

4. Is the current AH-1W T&R designed to provide adequate unguided weapons employment training sorties in order to develop individual pilot skills to meet established standards? What shortfalls have you identified? What are the strengths of the current T&R design with respect to unguided weapons employment?

5. Have you recognized any general trends (increasing skill, diminishing skill, etc.) with respect to unguided weapons employment skill levels within the AH-1W community? How do you, or your unit, attempt to quantifiably measure those skills?

6. Are unguided weapons employment skills important to current and future AH-1W missions?

Additional Comments:

Major Thomas A. Budrejko: AH-1W Cobra Division Head, MAWTS-1

1. Weapons Employment. This obviously assumes a basic level of airmanship required to get to & from the target area. An attack helicopter that is unable to effectively employ its weapons is a fraudulent waste of a sortie.

2. Absolutely. Laser-guided rockets must still be employed from within a viable ballistic envelope (not unlike LGB or JDAM). Lasers will not always be available. The tactical situation will not always permit employment from within precision parameters (farther from the target). Hardware will fail. People will err. Technology is not the answer to every problem.

3. No! Accuracy standards must be developed for each level (100, 200, 300, 400) that will be based upon weapon CEP. A reasonable threshold should be damaging effects (not suppressive) on every target pass. What could be tightened up as the syllabus progresses is the maximum miss distance.

4. No. Not nearly enough ordnance delivery opportunities. Any sortie that launches without ordnance is part-task training at best. I believe that an ideal syllabus would include roughly 25% non-tactical rocket & gun employment, at a scored range. We need to start treating our aircraft as if it were our T/O weapon. I recognize no strengths in the current syllabus, since there exists no valid standard to enforce.

5. Increasing skill within those units that have begun to enforce the ANTTP Weapons Release Envelope (currently there are three fleet squadrons that I know of). The exhausting condition is when pilots require "convincing" that they should really try to hit the target, as if that's up for debate. We definitely have a cultural problem in that area. Hopefully the latest generations of WTIs (and a few tactical COs) can fix this trend.

Here at MAWTS-1 we evaluate every single Weapons Release Event during WTI, Desert Talon, and on fleet support. Ineffective WREs are analyzed and debriefed candidly. Negligent release events (blatantly outside of envelope) are at times grounds for an unsatisfactory evaluation.

6. Absolutely. We are not just Hellfire shooters. We own a piece of the battlespace and a unique piece of the MAGTF puzzle. If we lose our ability to employ low-yield close-in fire support with a high target/sortie rate, then one would be better served launching a section of jets.

Major Michael H. Johnson: Marine Aircraft Group 26 WIT; former MAWTS-1 Instructor

1. Tactical employment of aircraft and weapons systems

2. Yes

3. Current version of T&R does not include standards for unguided weapons delivery. I've never seen a PUI receive unsatisfactory on a syllabus hop because of ordnance delivery. The tendency is to talk about and debrief it with the pilot, with the understanding that his weapons delivery skills will improve with practice. The current version of the MAWTS-1 AH-1W Course Catalog outlines accuracy benchmarks for all weapons systems (to be used during the conduct of instructor level checkrides (NSI, etc)). This is something that will be incorporated into the next revision of the T&R. These standards should be based on the skill level of a pilot in a specific phase of T&R syllabus progression (i.e. a 200 level PUI has lower standards to meet than a 300 level PUI who should be able to deliver ordnance more precisely).

4. I would say the syllabus is adequate but training ordnance allocation is sorely lacking. We all know that squadrons will go out with 5 rockets and 200 rounds to complete an BCWD or ordnance hop that requires 7 and 300. Unfortunately, we shoot ourselves in the foot on this matter because we don't show the requirement of the higher numbers.

Strength of the T&R design now is a building block approach. Pilots see mission sets at each level, which builds the foundation for them on that particular skill (i.e. CAS hop 200 level, CAS hop 300 level, 400 level Urban CAS, etc).

5. Tendency to treat rockets/20mm as "area" weapons. Overuse of "Kentucky" windage instead of using delivery systems and/or correcting boresight errors. Also degradation of skill in delivering weapons with certain systems (20mm HSS, FLIR 20mm) or delivery profiles (dive delivery

rockets). Those skills are not really being measured currently (needs to be addressed in more detail on next T&R revision).

6. Yes

Major Robert Finneran: former AH-1W Cobra Division Head, MAWTS-1

1. AHC should train PRIMARILY for weapons delivery and combat wingman...we have a tendency in the community to make AHC work-up more like section lead work-up.

2. Yes, guided rockets will be carried in limited numbers due to the cost and availability as the fleet is outfitted. There are also many target sets that do not require a precision weapon system but do require RAPIDLY fired, accurate ordnance.

3. No but...the T&R references the ANTTP and the MAWTS-1 course catalog. The 2007 version of the ANTTP has standardized the delivery parameters for unguided weapons delivery and the MAWTS-1 course catalog (draft) outlines in detail the performance requirements for all mission sets including unguided weapons delivery.

4. The T&R has the requisite sorties to conduct proper unguided weapons delivery training. The biggest shortfall is the fact that the T&R gives individual instructors and PTOs too much flexibility that results in poor training. Individual instructors often apply a tactical scenario to BCWD sorties and PTOs will often schedule BCWD hops as wing off of a higher level tactical sortie.

5. The general trend is poor rocket delivery at the beginning of a WTI course. The first day of the course students are scored on 7 rockets at a digitally scored range. Prior to WTI 1-08, students chose the profile and parameters to shoot and the instructors gave very little guidance...the idea was baseline of rocket delivery ability for each student. Throughout the course the instructors would then demonstrate and instruct the standard rocket delivery profile and students invariably improved throughout the course. WTI class 1-08 had to shoot rockets using the ANTTP parameters. The results were significantly better than previous classes where students were able to choose the delivery profile.

6. Yes, see # 2

Major Mark E. Van Skike: HMLA-369 Operations Officer; WTI

1. In my opinion, the skill set that best defines a Marine Attack Helicopter Commander is being a good Escort Flight Leader (EFL). A good and experienced EFL understands mission planning, rotary-wing escort, fire support coordination measures (FSCMs), fires integration, close air support (CAS), FAC(A), and supporting arms control. These skill sets are vital, integral, and embedded in the role of EFL.

However, that response may be too much for the intent of the question. If the intent of the question is what is most important for an AHC (tactical wingman) then I would say tactical formation flying skills and ordnance delivery accuracy. I need certain things from a tactical wingman; he needs to maintain section integrity and mutual support, and when the time comes he needs to be able to deliver his ordnance on time, and on target.

2. Skilled, unguided weapon delivery remains viable because the fact is we don't have guided rockets yet; although Urgent User Needs Statements (UUNS) requesting a laser guidance 2.75" warhead has been submitted. The primary reason unguided weapons such as the 2.75" rocket and 20mm remain an effective and viable weapon on the attack helicopter is its usefulness as a reactive weapon. Reactive weapons systems are at the heart of missions such as rotary-wing escort and armed reconnaissance. Escort and armed reconnaissance mission profiles remain completely viable in counterinsurgency warfare. The unguided weapon systems provide both a defensive and offensive capability to the attack helicopter.

3. The AH-1W T&R does not contain established standards for unguided weapons delivery. Many suggestions exist to add this standard to the T&R; however, my opinion may be different than a few. One option is to add accuracy standards to the sortie Performance Standard. In my opinion this would be difficult to manage for the following reasons: 1. Scored ranges are not prevalent to

score weapons accuracy. 2. The real learning objective starting out is to tactically train the AHC(UT) to deliver his weapons. In the tactical scenario, it may be more important to deliver the ordnance (defensive fire) and maneuver than to judge the accuracy of the hits; shoot, move, and communicate. 3. An AHC(UT) has not had enough ordnance practice to justify the scoring. I want to know that the AHC(UT) can deliver and employ his weapon systems, and the accuracy will come with experience.

If an accuracy standard is to be added to the T&R then my suggestion would be to add a specific sortie at the end of certain syllabi for the deliberate purpose of "scoring" unguided ordnance delivery. This sortie would be after multiple sorties where the AHC(UT) has had a chance to practice with more ordnance as well as allow the Operations Department the ability to schedule a scored range for the purposes of that sortie.

4. The T&R does direct certain standard ordnance loads for the purposes of completing the learning objectives for the sortie. This is good, and a strength of the T&R. In reality however, the amount of ordnance for the sortie (typically 7 rockets and 200 20mm) is insufficient to adequately build skilled unguided weapons delivery. With added money allocation for training for the GWOT, squadrons are typically being allocated more ordnance than has typically been available. Fourteen rockets and 400x20mm loadouts on ordnance sorties better represent what is needed to truly build unguided weapons proficiency.

5. The AH-1W AHC that has the bulk of his experience in the counterinsurgency campaign of OIF is very skilled at medium altitude unguided ordnance delivery from the race-track attack pattern. This is due to the repetition, and standard of performing weapons checks in OIF while en route to each mission. In my opinion, the high threat profile (high speed and low altitude) delivery of unguided weapons is a diminishing skill in the AH-1W community.

Our squadron conducted a "rocket derby" exercise on a scored range before deploying to our last OIF tour. The attached power point presentation presents our data recorded.

6. Yes, primarily for reasons described in response to questions two; the unguided weapons systems allow both a defensive and offense capability to the attack helicopter. A guided weapons system does not efficiently provide this capability.

Major Philip E. Eilertson: MAWTS-1 AH-1W Instructor

1. Weapons employment to me is the most important skill, b/c our platform was designed to have accurate fires on time to the customer. If we do flawless flight planning, navigate to the target, and communicate in order to identify the target, but yet fail to achieve the commander's desires on a nominated target then we have not completed our job. Furthermore, the customer's life may depend on our ability to address the targets, as well as our reputation as attack pilots is on the line.

2. Yes I do believe that unguided weapons employment is a skill that is viable and will be in light of advanced precision guided munitions. As proved by both OEF and OIF, not all target sets have a weapons to target match with precision guided munitions. Troops dug into a fighting position, people emplacing IEDs, ROE that dictates smaller yield weapons, not to mention reactive targeting where you don't have time to employ/set up for the use of a precision guided munitions. Target sets that have been observed in OEF and OIF don't always allow for precision weapons. From taking part in OEF, the terrain didn't allow us to standoff and use FLIR or DVO in every case. Many targets of opportunity where found just by looking around not to mention someone seeing with the Mark 1 eyeball a guy jumping out of a fox hole with an RPG. Reactive rockets and 20mm were the only weapon of choice in that scenario. These situations force us to always be ready to employ unguided weapons accurately on a moments notice, so we have to continue to train to this.
I have heard that several personnel working on the AH-1Z project have commented that the 4 bladed cobra is not built for unguided weapons but should only be concerned with precision guided munitions. This is very disconcerting b/c our support requirements for the Marine Corps won't change so why should our mindset as Attack Helicopter Pilots.

3. I think we do new Cobra pilots an injustice by not building them a good foundation. In the 100 level syllabus, the first simulator flight (SSWD-160) is designed to introduce Cobra Weapon

Systems, but doesn't have any "Demonstrate" items showing the student the correct profile for rocket delivery or gun employment. This simulator accomplishes its intent, to introduce the Cobra Weapons Systems, but why not start right from the gate and have an IP at least demonstrate correct profiles. Right now the first ordnance flight in the aircraft (SWD-161) is designed to introduce SWD Gunnery from the front seat and only has 400 rounds of 20mm required. I think we should add on at least (7) 2.75" rockets in order for the IP to demonstrate correct rocket profiles to link what he saw during the simulator to the actual aircraft. That would be a nice transition to the SSWD-162 which concentrates on rocket delivery. The SWD-163 doesn't specify employment range for rocket delivery but should in my opinion to drive home the point that the old style of shooting rockets from 2000 meters just doesn't allow you to achieve the level of accuracy required to have good ordnance affects on target. Also the SWD-163 would be even better if it specified the flight would be conducted on a scored bull range (Loom Lobby) or in the Zulu impact area. Typically the students weren't shown the correct profile for rocket delivery or if they were they haven't practiced enough in the aircraft or simulator to make this SWD-163 hop as productive as it could be. Also the T&R requires 5 inch zunni rockets but HMLA/T-303 doesn't get these, so why is it even a requirement in the T&R. I still agree we need to continue to shoot the 5 inch zunni rockets, to make sure we don't lose the art of shooting these if the tactical need arises to employ this weapon in the future. The first SWD flight in the 200 level syllabus is a simulator designed to prepare the student to fire their first live TOW and Hellfire missile. This is fine but the next flight in the SWD 200 level syllabus is another simulator that focuses on rear seat weapons proficiency. In the T&R it lists employment from 500m-2000m, which is something that needs to be changed to 800m-300m employment range for rocket delivery. From there the T&R goes right into NVD rocket delivery with the same 500m-2000m SWD 244 flight, which needs to be changed.

What needs to happen, and we are going to try and push this during our T&R working group 15 Jan – 18 Jan, is to encorporate a scored bull flight that concentrates on weapons accuracy in the 200 level syllabus and make the scored bull part of a 300 level stage check flight. Then we are going to make the 300 level X a 180 day requirement to enforce focus on weapons delivery accuracy. Further more the current T&R doesn't have enough ordnance requirements in order to train to a higher standard of accuracy. The reality of the situation, when speaking on more ordnance to train, is the Marine Corps doesn't have the budget to get the amount of ordnance that we really need to train too and maintain high accuracy standards, but by increasing the requirement it will help the argument when going to Ordnance reviews if we have supporting documentation to back up the request. The other item to tackle with the T&R re-write is to encorporate a building block approach to accuracy standards by stage. I am on board with your idea of making the 200 level end of stage check flight accuracy standard/goal of shots with in 40m of the target on each pass. Making sure that on each pass the correction hits w/in 40m of the target. Then for the 300 level stage check flight (AHC check) have a standard/goal of shots w/in 30m, then for the 400 level stage have a standard/goal of with in 10m. That isn't the gospel but the thought process of having a graduating type standard will force guys to take gunnery more serious. The fleet would have to be on board with this and help uphold this standard for the stages.

4. See above comments on question #4.

5. I have seen a general trend this last year of WTI students taking unguided weapons employment more seriously. As you saw from Bull's email by forcing WTI students to employ from a range of 800m to 500m, their accuracy blew out the last 6 classes. We have yet to see the fruits of our labor out here b/c those WTI graduates have to take those goals/standards and enforce them as well as teach them in their squadrons. As to quantifiably measure those skills, I have addressed this above.

6. The threat does change but CAS doesn't so therefore we still need to train to accuracy close to ground troops.

Major Richard B. Ashford: MAWTS-1 AH-1W Instructor

1. Basic airmanship leads to weapons employment...that's what we do...that is our bread and butter and should be our emphasis. What I mean by that is that we throw a lot of systems and tactics at the young guys and bypass or take for granted that they can do (or will learn to do) all of the "easy stuff" despite our lack of emphasis on it. A guy has to be able to fly the aircraft to its limits by subconscious alone, leaving his conscious side to gain and maintain situational awareness and deliver weapons accurately. Long answer to a short question, an aspiring AHC should train to be the best pilot he can be, which will allow him to focus on weapons employment.

2. Absolutely. Unguided weapons employment skills cannot be separated from pilotage. Those skills that an AHC must master as a pilot present themselves directly through his ability to deliver unguided weapons. An AHC who can master unguided weapons employment obviously has the basic stick and rudder skills necessary to fly the aircraft to its capabilities.

That being said...the AH-1Z has a problem with rocket gas ingestion. Because of this problem, the Z can deliver a maximum of 2 rockets (one per side in pairs) every 2 seconds, unless airspeed is greater than 130 knots. Those who have flown the AH-1Z and delivered rockets have noted that these restrictions on flight envelopes are unacceptable. The common answer is that "we're not building the Z to shoot rockets".

With the advent of "newer, cooler" weapon systems and platforms, the commonly held belief is that a GPS coordinate or laser spot is the best way to get the most accurate result for your given weapon. While that may be true for some weapon systems and certainly for some platforms, that all "precision weapons" or nothing line of thinking is largely responsible for driving us away from spending more time on unguided weapons delivery (BCWD).

3. The T&R has stayed away from hard and fast numbers, but I think we're going to change that. We have hard numbers for rockets and 20mm in the Course Catalog and have been holding the hammer on their enforcement in a renewed emphasis on shooting well.

4. No. The current T&R is designed to give a guy enough looks at rkt/gun shooting to give him a feel for it, but pass/fail of the hop is not tied to whether or not he is able to do it accurately. "That's what shooting from the back seat looks like during the day, that's what shooting from the back seat looks like at night. Congratulations, now let's work on AR." We don't spend enough time simply developing the skill, teaching him to shoot rockets (for example) from high alt, med alt, low alt, in a hover, running, fast, slow, low angle, high angle, day, HLL, LLL, etc... It takes time to develop true "feel" for the aircraft and for proper "stick and rudder" to utilize the aircraft to the max of its ability. Teach a guy to fly the aircraft and don't let him think about anything else until he can do that, then teach him to shoot it and don't let him think about "tactics" more than nose on target stuff until he can do that to a certain standard, then teach him about the finer points of OAS, assault support, etc...

We are not there yet in the T&R, but a lot of those ideas will take form when the program guide and T&R are re-organized by skills first, then missions, a change that ATB has been promising for some time now.

5. Yes. I think we're getting better. One of the biggest quantifiable changes came when we were finally allowed to keep pods on the aircraft. The pods are hung on the aircraft, boresighted, and they stay on, vice always hanging an unboresighted pod every time through the CALA.

In the past, because we always had unboresighted pods, the attitude was largely that of "we'll take whatever we get, just shoot the 7 rockets and you get the X" because it's hard to hold a guy to a standard if you really don't know where the rockets are going to go. But since we implemented

boresighted pods on aircraft 24/7, we've seen a marked improvement in training value per rocket as there are literally no excuses to miss, other than poor technique. Personal pride in rocket shooting seems to be way up and that helps drive our push for success. You may do everything else well, but if you can't shoot, you're going to be harassed mercilessly until you unscrew yourself, especially because we also have the OIF/OEF mission to prepare for. It is no longer okay (and I think it used to be for some because it was "peacetime") to spray and pray with rockets. The first one better be right where it was supposed to be and all the others better follow or else.

6. Since you said AH-1W, I can say yes absolutely. It is extremely important that we make our case for AH-1Z or way may very well lose that fight.

It is important to the AH-1W because it is important to us as pilots. Shooting a HF is fun, but doesn't require any pilotage and I can practice that on my home computer if I really want to. Give me a rocket and the opportunity to shoot it any day and I'll take it. There's nothing like being over the shoulder of the grunts in the fight and shooting rockets at bad guys less than 500m away. It's up close and personal and how accurate those fires are depends 99.9% on me and my ability to do it. That kind of fight, that kind of ability and that attitude are a lot of what make our community great. We're not systems managers that haul bombs and push buttons; we're more an airborne extension of the ground fight than any other platform, largely because of our ability to do these things. We can't afford to lose our emphasis on these basics.

Additional Comments:

I've been flying the AH-1Z since Nov, and it has a whole slew of differences, mostly due to glass cockpit and emphasis in different places. If you want more of my thoughts on where we have to be careful going down that road, I'd be happy to give them to you, just wasn't sure if you really wanted that stuff included.

Major James J. Brown: MAWTS-1 Instructor

1. Weapons Employment

2. Yes. PGM's cost more and may not always provide the answer. Still need unguided munitions in our bag of tricks.

3. No-no standard is in the T&R. I think the 10 meter ECR should be the standard. We need the ability to start debriefing tapes like the Hornet community. All Weapon Release Events should be cataloged somehow to be able to talk about range, dive angle, power setting, ball and all perameters on the shots both rocket and gun

4. No. We do not get enough ordnance to make guys good by the time they become AHCs. We should have it in our T&R or somewhere that guys get to shoot at least 14 rockets per month to get good and keep that skill set.

Strengths of the T&R are it is in the building block approach for unguided weapons employment, but we need more proficiency flights built into the refly interval.

5. I have seen us get better since OIF. Before as I was a 200 level guy, if you got rockets off the aircraft, that was a good flight. Now we hold guys feet to the fire as to whether they hit the target. In the open desert a 40 foot miss looks close to the target from 800 meters and guys maybe get a false sense of hitting the target. In an urban environment, a 40 foot miss is two buildings over and guys realize they need to hit the target and not the general area.

6. Absolutely! We are losing the TOW with Zulu and if your HF system is not working, you need to be able to support the GCE, who is the ultimate customer.

APPENDIX O: Delivery Accuracy

Source: *Air NTTP 3-22.3-AH-1W, Combat Aircraft Fundamentals - AH-1W (U)*July 2007, 3-34.

Table 1: Delivery Accuracy in a 20-Degree Dive

Weapon	Range-Over-Ground to Target at Weapons Release			
	300m	**500m**	**800m**	**1000m**
2.75" Rockets	10.668m	18.288m	30.48m	39.624m
Fixed-Forward 20mm	7.62m	13.716m	22.86m	28.956m

*Original distances converted from Feet to Meters for consistency of study

Accuracy Values. Theoretical accuracy values (in meters circular error probable [CEP]) are provided in Table 1, Delivery Accuracy in a 20-Degree Dive. These values are based upon several assumptions, including a high-degree of systems maintenance, perfect boresight of cannon and rocket pods, no pod or barrel wear, zero-wind, known distance (KD), and zero aircrew error. Accuracy deteriorates rapidly as range is increased, and is not a linear degradation.

APPENDIX P: Acronyms and Abbreviations

A/A	Air-to-air	
AA	Antiaircraft or avenue of approach	
AAA	Antiaircraft artillery	
AAM	Air-to-air missile	
AAW	Antiair warfare	
ABF	Annular blast fragmentation	
ACA	Airspace coordination area	
ACC	Air Control Center	
ACE	Aviation combat element	
ACI	Airborne control intercept	
ACL	Aircraft centerline	
ACLOS	Automatic command to line of sight	
ACM	Air combat maneuvering	
AD	Air defense	
ADA	Air defense artillery	
ADI	Altitude director indicator	
ADL	Armament datum line	
AFL	Assault flight leader	
A/G	Air-to-ground	
AGM	Air-to-ground missile	
AHC	Attack helicopter commander	
AI	Aerial Interdiction/Airborne interceptor	
ALT	Altitude, MSL unless specified AGL	
AMC	Air mission commander/at my command	
ANSQ	Advanced night system qualification	**(Core Skill)**
ANVIS	Aviators night vision imaging system	
AO	Angleoff/area of operations	
AOA	Amphibious objective area/angle of attack	
AP	Antipersonnel	
APAM	Antipersonnel and material weapon	
APC	Armored personnel carrier	
APF	Aircraft parachute flare	
API	Armor piercing incendiary	
APKWS	Advanced Precision Kill Weapon System	
AR	Armed reconnaissance	
ASC(A)	Assault support coordinator (airborne)	
ASE	Air support element or aircraft survivability equipment	
AT	Antitank	
ATF	Amphibious task force	
ATGM	Anti-tank guided missile	
ATO	Air tasking order	
AUR	All-up-round	
AW	Automatic weapons	

BCL	Battlefield coordination line	
BD	Base detonating impact firing fuse	
BDA	Bomb damage assessment	
BDU	Bomb dummy unit	
BP	Battle position/Break point	
BPT	Be prepared to	
BRU	Bomb release unit	
C3	Command, control, and communications	
CAS	Close air support	
CATF	Commander, amphibious task force	
CEP	Circular error probable	
CFACC	Combined force air component commander	
CFL	Coordinated fire line	
CP	Control point/Covering point/Checkpoint	
DAS	Deep air support	
DASC	Direct Air Support Center	
EFL	Escort flight leader	
ESC	Escort	**(Core Skill)**
ETA	Estimated time of arrival	
EVM	Evasive maneuver	
EW	Electronic warfare	**(Core Skill)**
FAC	Forward air controller	**(Core Skill)**
FAC(A)	Forward air controller (airborne)	
FARP	Forward arming and refueling point	
FEBA	Forward edge of battle area	
FENCE	Fire control, emissions, navigation, communication, expendables	
FIST	Fire support team	
FLOT	Forward line of own troops	
FO	Forward observer	
FOB	Forward operating base	
FP	Firing point	
fps	Feet per second	
FRAG	Fragmentation	
FRS	Fleet replacement squadron (HMT-303)	
FS	Front seat	
FSC	Fire support coordinator	
FSCC	Fire Support Coordination Center	
FSCL	Fire support coordination line	
GCE	Ground combat element	
GHS	Gunner helmet sight	
GTL	Gun-target line	
HA	Holding area	
HAC	Helicopter aircraft commander	
HE	High explosive	
HE-T	High explosive with tracer	
HEALT	Helicopter employment and assault landing table	

HEAT	High-explosive anti-tank
HEI	High explosive incendiary
HEI-T	High-explosive incendiary with tracer
HLL	High light level
HMLA	Marine light/attack helicopter squadron
HOB	Height of burst
IP	Initial point, Instructor Pilot
JIPTL	Joint integrated prioritized target list
JMEM	Joint Munitions Effectiveness Manual
KCAS	Knots calibrated airspeed
KIAS	Knots indicated airspeed
KM	Kilometer
LIC	Low intensity conflict
LLL	Low light level
LOS	Line of sight
LSR	Laser
LTD/RF	Laser target designator/range finder
LZ	Landing zone
MACCS	Marine Air Command and Control System
MAGTF	Marine Air Ground Task Force
MANPADS	Man-portable air defense system
MAWTS-1	Marine Aviation and Weapons Squadron One
MCO	Marine Corps Order
MCRP	Marine Corps Reference Publication
MCTs	Marine Corps Tactical Tasks
METL	Mission essential task list
MGRS	Military grid reference system
NATOPS	Naval air training and operating procedures standardization
NAV	Navigation
NM	Nautical miles
NOE	Nap-of-Earth
NTS	Night target system
NVD	Night vision device
NVG	Night vision goggles
OAS	Offensive air support **(Core Skill)**
OIF	Operation Iraqi Freedom
PAC	Pilot at the controls
Pd	Probability of destruction
PD	Point detonating impact firing fuse; pulsed Doppler
PGM	Precision guided munitions
PGU	Projectile gun unit
Ph	Probability of hit
PIP	Projectile impact point predictions
PK	Probability of kill
PNAC	Pilot not at the controls
POI	Program of instruction

PQM	Pilot qualified in model	
PUI	Pilot under instruction	
PWTI	Prospective Weapons and Tactics Instructor	
REC	Reconnaissance	**(Core Skill)**
RECCE	Reconnaissance	
ROT	Rules of thumb	
RPM	Rounds per minute	
RS	Rear seat	
RWCAS	Rotary wing close air support	
SAD	Safe and arm device	
SAM	Surface-to-air missile	
SAP	Semi-armor piercing	
SAPHEI	Semi-armor piercing high explosive incendiary	
SCAR	Strike coordination and reconnaissance	
SCL	Standard conventional load	
SDZ	Surface danger zone	
SOP	Standard operating procedures/Standing operating procedures	
SR	Slant range	
STD	Standard	
SWD	Specific weapons delivery	**(Core Skill)**
TACMAN	Tactical Manual (replaced by Air NTTP 3-22.3-AH1W)	
TACP	Tactical air control party	
TD	Target designator	
TDC	Target designator control	
TDD	Target detecting device	
TERF	Terrain flight / navigation	**(Core Skill)**
TGT	Target	
THCDP	TOW/Hellfire control display panel	
THCDS	TOW/Hellfire control display system	
TIC	Troops in contact/Target intelligence center	
TOO	Target of opportunity	
TOT	Time on target	
TOW	Tube-launched, optically tracked, wire-guided	
TP	Thermal protective coating/target practice	
TRAP	Tactical recovery of aircraft, equipment, and personnel	
TRP	Target reference point	
TTP	Tactics, techniques, and procedures	
T&R	Training and Readiness Manual	
UAV	Unmanned aerial vehicle	
USAF	United States Air Force	
VID	Visual identification	
VR	Visual reconnaissance	
VT	Variable time fuze, a proximity fuze	
WCS	Weapon control system	
WISS	Weapons Impact Scoring Set	
WP	White phosphorous	

WPNS	Weapons
WRDU	Wing rocket delivery unit
WTI	Weapons and Tactics Instructor
WTL	Weapon-to-target line

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